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# POLICY INSIGHTS FROM AN ASSESSMENT OF NEPAD E-SCHOOLS IN RWANDA

*A CASE STUDY OF THREE NEPAD E-SCHOOLS IN RWANDA*

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A research report submitted to the

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**Abstract**

The purpose of this research is to investigate how the Rwanda NEPAD e-schools project is achieving its objectives, in order to draw lessons for policy. Case studies of three NEPAD e-schools were conducted to explore the integration of ICT in schools. This qualitative research was based on semi-structured interviews with Ministry of Education staff, school personnel and students, as well as a review of policy documents. The literature review identified a number of factors that hinder the use of ICT, which factors were also evident in the research findings. It was found that greater support is required to overcome the barriers, including lack of policy, teaching and learning, funding, access, training and professional development, curriculum content, technical support, time and attitudes towards ICTs. The analysis of the position in these e-schools offers lessons for policy and practice in Rwanda and with regard to the NEPAD e-schools programme on the continent. Ministries of Education in African countries should align ICT in education policy with other education strategic and operational policies to ensure that ICT initiatives are in line with national developmental goals and objectives.

**Declaration**

I declare that **Policy insights from an assessment of NEPAD e-schools in Rwanda,** a case study of three secondary schools in Rwanda, are my own, unaided work. It is submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand in partial fulfillment of the requirements for the degree of Masters of Management in ICT Policy and Regulations (MMICTR). It has not been submitted before for any degree or examination at any other university. Where the efforts of others have been used, all the sources that have been used or quoted have been acknowledged by means of complete references.

Karangwa ..... 03/May/2012

SIGNATURE DATE

(EUGENE KARANGWA)

**Dedication**

To God who made all things possible for my own good in the course of my study.

To loving parents

To brothers

To sisters

To relatives

To friends

Due to your presence, love, joy, care and entire life shared, elevated me to be myself. I recognise and appreciate your support. I dedicate this work. Thank you

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First and foremost, my heartfelt thanks to LORD almighty for having cleared the way for me to complete my course. I know without your incredible guidance and amazing strength I would not have made it this far.

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I would like to extend my sincere gratitude to the Government of the Republic of Rwanda that has facilitated my study, my sincere thanks is also directed to Wits University that accepted me to study at their school and all the facilities they provided.

I sincerely direct my thanks to my Father and Mother, my brothers, sisters and relatives for their contribution and prayers and all that you provided.

I thank Ministry of Education- Rwanda to grant me permission to access research schools; I would also like to thank three NEPAD e-schools (College Christ Roi, College St.Andre and ESSA Gisenyi) for giving me the opportunity to conduct my research in their schools. I particularly thank the principals, teachers and students who took their time to attend to my interviews.

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**List of abbreviations**

| | |
|---|---|
| AfDB | African Development Bank |
| AISI | Africa Information Society Initiative |
| AMD | Advanced Micro Devices |
| ATM | Automated Teller Machine |
| BECTA | British Educational Communications and Technology Agency |
| CERI | Centre for Educational Research and Innovation |
| CLP | Country Liaison Person |
| DoE | Department of Education |
| EDPRS | Economic Development and Poverty Reduction Strategy |
| ESSA | Ecole des Sciences de Gisenyi |
| GDP | Growth Domestic Product |
| GeSCI | Global e-Schools and Communities Initiative |
| GIS | Geographical Information Systems |
| GoL | Gauteng Online |
| GoR | Government of Rwanda |
| HiWEL | Hall in the Wall Education Limited |
| HP | Hewlett Packard |
| ICT | Information Communications Technology |
| ICT4D | Information Communications Technology for Development |
| IGE | Inspectorate General of Education |
| IT | Information Technology |
| KIST | Kigali Institute of Science and Technology |
| MDGs | Millennium Development Goals |
| MIFOTRA | Ministry of Public Service and Labour |
| MINALOC | Ministry of Local Government and Good Governance |
| MINECOFIN | Ministry of Finance and Economic Planning |
| MINEDUC | Ministry of Education |
| NCDC | National Curriculum Development Centre |
| NCHE | National Council for Higher Education |
| NEPAD | New Partnership for Africa's Development |
| NGO | Non-Governmental Organisation |
| NICI | National Information and Communications Infrastructure |
| OAU | Organisation of African Unity |
| OLPC | One Laptop per Child |
| PIL | Partners in Leaning |
| PPPs | Public Private Partnerships |
| PTA | Parents Teachers Associations |
| RITA | Rwanda Information Technology Authority |
| RNEC | Rwanda National Examinations Council |
| SAIDE | South African Institute for Distance Education |
| SFAR | Student Financing Agency for Rwanda |
| TCO | Total Cost of Ownership |
| TSC | Teachers Service Commission |
| TVET | Technical Vocational Education and Training |
| UMWALIMU SACCO | Umwalimu Savings and Credit Cooperatives |
| UN | United Nations |
| UNECA | United Nations Economic Commission for Africa |

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# CHAPTER ONE

## THE NEPAD E-SCHOOLS PROGRAMME AND A RWANDAN CASE STUDY

### 1.1 Introduction

This research investigates the importance and use of ICTs in the New Partnership for Africa's Development (NEPAD) e-schools in Rwanda, the effect of NEPAD e-Schools initiative on student's motivation and engagement for learning, the impact of information and communication technology (ICTs) on teaching, learning and investigating enablers and barriers for effective utilisation and integration of ICTs in Rwandan schools.

The pervasiveness of information and communication technology (ICT) extends into all aspects of both society and our lives, including education. Governments and institutions all over the world acknowledge the importance of information and communication technology (ICT) in education improvement and delivery and large investments have been made to increase the number of computers and Internet access in schools (Trucano, 2005; Kozma & Anderson, 2002; Bransford, Brown & Cocking, 2000; Grimus, 2000, Yelland, 2001).

Studies in the field of ICTs have shown that ICTs have become essential tools in today's information age, making significant changes in lives of people worldwide. This effect is more important in education. In schools worldwide; computers have become motivating tools in teaching and learning (OECD, 2001; Watson, 2001). The information delivery services through the Internet has become cost-effective, Internet has also allowed more collaboration and distance learning more than ever thought of (Bauer & Kenton, 2005, OECD, 2001). Considering the efforts and heavy investments by different governments in equipping schools with ICT, the integration of technology into teaching and learning continue to pose a complex and demanding process (Cooper, 1998), and yet successful integration of technology into curriculum has yet to be realised (Kozma & Anderson, 2002).

Governments invest huge sums of money in order to prepare students for the knowledge economy and information age, by implementing ICT in schools (Pelgrum, 2001). ICT policies are formulated, computer hardware and software are put in schools and schools are connected to the Internet (Pelgrum, 2001). Governments spend such huge sums of money in

implementing ICT in schools so that schools can produce students that will be future competent workers in today's knowledge and technology based economy (Pelgrum, 2001).

### 1.1.1 NEPAD e-schools

The NEPAD is a Vision and strategic framework by the Organisation of African Unity (OAU) that mandated five African heads of state (Algeria, Egypt, Nigeria, Senegal, and South Africa) to develop a framework for socio-economic development of Africa. After realising the current challenges that face Africa like extreme poverty and underdevelopment, there was a need for an intervention spearheaded by African leaders themselves based on common vision and enthusiasm that they have a duty as leaders to address those challenges and bring Africa to the path of sustainable growth and development (NEPAD, 2005).

To harness the implementation of NEPAD e-schools initiative, NEPAD established e-Africa Commission, a NEPAD task team responsible for developing and implementing NEPAD ICT programme. The Commission is expected to work in partnerships between different stakeholders including governments, private sector and civil society organisations, these partnerships created to fulfill the objectives of NEPAD ICT programme is called the Information Society Partnership for Africa's Development (ISPD) (NEPAD, 2005).

The NEPAD e-Schools project, a continental initiative aimed at equipping young Africans with skills necessary to work and participate in the emerging information society and knowledge-based economy, the initiative also aims at using technology to enrich and improve education in African countries. The initiative was formed in 2003 at the Africa Summit of the World Economic forum in Durban. The Ministries of Education in participating countries run the NEPAD e-schools initiative in partnership with consortia of private companies led by the five big Information Technology (IT) companies (Cisco, Microsoft, HP, AMD, and Oracle).

The NEPAD e-schools initiative aims to equip more than 650,000 schools in Africa both primary and secondary with computers, teaching of ICT skills to both students in primary and secondary, provide digital learning materials, Internet connectivity and ICT skills training to teachers to enhance teaching and learning by the year 2020 (Farrell, Isaacs & Trucano, 2007).

A public report on the work in progress of the NEPAD e-school Demonstration project found that a cost-benefit analysis was not available and has never been done. Costs are crucial in

policy decision making and there is no information available on the cost-benefit analyses for the implementation of NEPAD e-schools.

> Cost-benefit studies of ICT interventions in the education sector can be difficult even in the best of circumstances, but, within the context of the Demo project, it was never made clear to the consortia that providing cost data was expected. As a result, these data were for the most part unavailable to the M&E team (Farrell, Isaacs & Trucano, 2007:12).

### 1.1.2 Rwandan e-schools Programme

Rwanda is among sixteen pilot countries[1] in Africa that benefited from NEPAD e-schools initiative; six schools were selected from each of the sixteen participating countries. In Rwanda, the selected public schools are St Andre, Groupe Scholaire Muhura, ESSA Gisenyi, Christ Roi, Lycee de Zaza, Group Scholaire Shyangi, two of which are urban (St Andre, ESSA Gisenyi) and four of which are rural (Christ Roi, Lycee de Zaza, Group Scholaire Shyangi, Groupe Scholaire Muhura). NEPAD e-schools programme in Rwanda was officially launched by his Excellency President Paul Kagame in October 2006 at Groupe Scolaire Muhura in Gatsibo District in Northern Province of Rwanda.

The NEPAD e-schools demonstration project was to serve as a lesson for the effective deployment of NEPAD e-schools project on the whole African continent, it is important that schools chosen for the NEPAD e-schools demonstration give a clear reflection of a variety of African school settings. The criteria were set to choose participating schools in the demo, and the criteria were:

- All six schools should be at a secondary or equivalent level;
- There should be a mixture of urban and rural schools;
- If possible, one of the schools should be without access to electricity;
- There should be a mixture of schools in terms of size;
- All six schools should have a room that could be utilised for setting up an ICT laboratory;

[1] **Sixteen NEPAD e-schools pilot countries are:** Algeria; Burkina Faso; Cameroon; Egypt; Gabon; Ghana; Kenya; Lesotho; Mali; Mauritius; Mozambique; Nigeria; Rwanda; Senegal; South Africa; and Uganda. http://www.infodev.org/en/Project.6.html

- There should be good security;
- The teachers at these schools should be willing to avail themselves for various training courses (NEPAD, 2005:4)

In Rwanda, the choice of participating schools in the NEPAD e-schools demonstration project followed the same criteria set by NEPAD e-Africa Commission. All schools selected for the demo are secondary schools, two schools are urban and four schools are rural, one of the participating schools (Group Scholaire Muhura) which was also NEPAD e-schools demo launch school had no grid electricity, CISCO[2] which was responsible for implementation of the demo in that school partnered with Inveneo[3] and provided solar energy to power the school computer lab and whole campus, all the schools had a room to be used as a computer lab and security guaranteed and teachers participated willingly in trainings.

The second criteria that Rwanda considered was geographical location, since e-schools were to act as a model of ICT in other schools, Rwanda considered distributing schools equally to all provinces of the country without violating e-Africa Commission criteria. Rwanda has five Provinces and in each Province one school was selected, but one Province (Eastern Province) is geographically bigger than other provinces, so that criteria gave it an advantage of having two NEPAD e-schools. The schools were then further selected because of heads of schools that showed more willingness and collaboration when called upon by the Ministry of Education.

All the six schools are government schools catering for senior one to senior six[4]. All six schools have strong reputations in their vicinity, and this was also another criteria for selection of the school to participate as a NEPAD e-school.

Although Rwanda is committed to pursue the integration of ICT in Education; it is not capable of funding all the ambitious ICT in education projects that are stipulated in its national ICT policy, so partnerships (Public Private partnerships-PPPs) are crucial to complement the funding and implementation of ICT in education projects. The evidence available clearly indicates that these PPPs are already being implemented as pilot projects in

[2] **CISCO**: It is not an acronym, it's a short form for San FranCISCO

[3] **Inveneo** is a non profit social enterprise that develops sustainable products and solutions to deliver the life-changing benefits of information and communication technologies (ICTs) to individuals and organizations in rural and remote areas of the developing world. http://www.cisco.com/web/about/citizenship/docs/inveneo.pdf

[4] **Senior one to Senior Six**: Refer to six years of secondary schooling after primary education in Rwanda education system

Rwandan schools, among these are the NEPAD e-schools initiative, One Laptop per Child (OLPC) initiative, the World Links Project, Microsoft Partners in Learning (PIL), Hole in the Wall Education Limited (HiWEL), Azim Premji Foundation, among others. These partnerships have focused on provision of infrastructure (hardware and software), Internet connectivity in schools, training of teachers and training of trainers and digitising of educational content.

These initiatives have led to increased awareness of ICTs in general and access to ICT in participating schools in particular, however the information on the impact of such initiatives is not sufficient. This research focus only on NEPAD e-schools project, the research will not focus on other initiatives since that falls outside the scope of the study.

Many governments have invested in introducing ICT in schools, including hardware, software, teacher training in use of computer technology and networking of labs and classrooms. In introducing ICT in schools, they expect the use of ICTs can improve education if used effectively. Students can improve and resolve the learning experiences by accessing relevant learning resources and special needs students would have new promises open to them.

In South African Gauteng province, there is an initiative to introduce computer labs in schools, the introduction of Gauteng on Line (GoL) was to give learners and communities IT literacy and equip them with necessary skills that will enable them have access to resources for learning, equipping them with ICT skills for getting employment. Mpehle's (2011) study revealed that while the project has had significant progress since its introduction, there has also been challenges and the project in most of GoL schools is offline, and has not achieved success as was planned, among challenges found in the study were, infrastructure were not up to standard, there was a problem of security and theft of computers, there was lack of ownership and community involvement, installation was not followed by monitoring and evaluation to ensure success of computer use in schools and training provided to computer lab managers was found to be inadequate (Mpehle, 2011). Evidence that the introduction of ICT in Rwandan schools has impact on the performance and progress of students would be valuable for the design of an e-education policy for Rwanda.

## 1.2 Overview of education in Rwanda

### 1.2.1 The Republic of Rwanda

Rwanda is a landlocked country in east-central Africa, also known as the land of a thousand hills. Rwanda covers a land area of 26,340 square kilometers and a population of 10 million. Its capital city is Kigali and its currency is Rwandan franc (AfDB, 2010). Rwanda boarders Uganda to the north, Burundi to the south, Democratic Republic of Congo to the west and Tanzania to the east. It is divided into 4 provinces and Kigali city. Rwanda's GDP is US $ 5 Billion, and its real GDP growth of 5%. Gross enrolment ratio in primary education is 152.0% and 20.80% in secondary (AfDB, 2010).

### 1.2.2 Education system in Rwanda

Rwanda Education system has under gone significant reforms since pre-colonial era. Before colonialism, education was informal and was delivered through elder members of the family, there were no school setting as we see them today, but Rwanda had its own traditional education system, education institutions were essentially the family where young girls learnt the household management skills like iron smith, foundry and basket making from their mothers while the boys acquired the wisdom of life like military and war skills from their fathers (Obura, 2003)

During colonialism, the Catholic Church was the first institution to introduce formal education in Rwanda, Until 1950s there were few public primary schools and only one secondary school established by catholic missionaries in 1929, this school was attended by the then children of the then notable people in the country. In 1962, following independence, the education system in Rwanda was transformed, administrative structures including Ministry of Education were put in place and a number of primary and secondary schools were put under the jurisdiction of the Ministry of education. This increased the power and control of schools by government; however no much change could be seen in practice, colonisers maintained influence and control of education as planners and advisors in education system (Des Forges, 1999).

Before 1994, the education system in Rwanda was discriminatory; one the most important factor that led to the 1994 genocide in Rwanda. Obura (2003) stressed that a discriminatory system existed and was used for entry into schools in Rwanda, which was explicitly based on ethnic and regional criteria rather than on student performance. Obura argues that "it is now

thought that, to a large extent, the education system mirrored and indeed reinforced destructive trends in Rwandan society." (Obura, 2003:17).

In 1994, Rwanda experienced a Tutsi genocide which devastated the whole country. The 1994 Tutsi genocide claimed more than one million people in only one hundred days. This tragic event targeted mostly the skilled and economically active people, and tragic event put the county more than one generation back as far as human resources are concerned. This has affected all sectors of the Rwanda's economy, public, private and civil society. During that time, most infrastructure were destroyed including schools, teachers were killed and others fled the country and many of households were left headed by children and all were traumatised (Obura, 2003)

### 1.2.3 Educational system after 1994 genocide

After the genocide of 1994, the government passed through an emergency situation, trying to revive and reshape all the sectors of the national life and reshaping the education system as well. The most pressing issue the government had to undertake after genocide as Obura (2003) pointed out was to mobilise resources both from the internal and external partners to re-open schools (Obura, 2003). The government in re-organising the education system had to struggle with challenges like lack of qualified teachers and shortage of teaching materials.

However, only two months after genocide, the government achieved a rapid restart (Obura, 2003), the government re-organised and started many schools and settled a big number of children who were returning to Rwanda after the war and genocide.

It is in this regard that the 1998 education sector policy was adopted and since it was after events that shattered the country in 1994 that led to a genocide, the policy focused mainly on reconciliation and unity and how to deal with the situation that was prevailing at the time in order to achieve a change in education system (MINEDUC, 1998). This policy was revised in 2003.

### 1.2.4 Present Rwanda schooling system – Structure and Operation

Rwanda' s Education system is structured in five cycles, pre-primary which presently is run by private individuals and the role of government is only at the level of policy making and supervision, 6 years of primary, 3 years lower secondary, 3 years of upper secondary and 4 years of higher education in most disciplines except medicine. Both primary education and

lower secondary education is fee-free from 2004 and 2006 respectively and education is provided by public (government schools and government supported schools), lower secondary is mostly public supported, although 34% of the schools are still private schools, upper secondary requires fee payment and 50% of upper secondary schools are private. In the past, public higher learning institutions did not charge fees for students, their fees and living allowance were paid by the state as a loan for which a student will pay a certain percentage when he/she starts working (MINEDUC, 2003). The policy has been revised in 2011, government pays tuition fees but a student pays for their accommodation and living allowances in public higher learning institutions (MINEDUC, 2011)

Rwanda Education sector is governed by the Ministry of Education (MINEDUC) as a lead ministry and responsible for education sector policy formulation. "MINEDUC has the major responsibility in leading education sector and this responsibility has been designated in the national Economic Development and Poverty Reduction Strategy (EDPRS) …" (MINEDUC, 2008a:5). However there are other ministries, public institutions, private and NGOs which have significance involvement in education provision and development in Rwanda. The semi-autonomous bodies affiliated to MINEDUC have a very important role in education system. The National Curriculum Development Centre (NCDC) develops and reviews curriculum for pre-primary, primary and secondary schools. Rwanda National Examination Council (RNEC) runs the examination system. General Inspectorate of Education (IGE) inspects primary and secondary schools. The Teacher Service Commission (TSC) caters teacher development and management. Student Financing Agency for Rwanda (SFAR) administers student loans and grants in the higher education system. The Umwalimu Savings and Credit Scheme (UMWALIMU SACCO) is a teacher credit and savings cooperative and the National Council for Higher Education (NCHE) for accreditation of higher learning institutions (MINEDUC, 2008a).

With decentralization, the Ministry of Local Government and Good Governance (MINALOC) has also a role to play in education, they monitor the performance of decentralised roles of provinces and districts regarding education. The other ministries that have a role to play in education system are Ministry of Public Service, Skills Development, and Labour (MIFOTRA) which sets and manages salary and conditions of service for teachers and Ministry of Finance and Economic Planning (MINECOFIN) which sets broad policies and planning frameworks and manage education financial planning (MINEDUC, 2008a).

Under decentralization, districts are directly responsible for the delivery of services and oversight of schools, districts monitor secondary schools and sectors monitor primary schools. Each district has two officers in charge of Education and in 2009 there was an additional staff at the district in charge of teacher management and at the sector level there is an officer in charge of social affairs including education. Schools have more responsibility over education in their respective schools, schools have school boards and Parent Teachers Associations (PTA) where they report their financial management and expenditures, performance contacts are signed between head teachers and teachers to assess their regular performance (MINEDUC, 2008a).

## 1.3 Overview of Rwandan Schools

### 1.3.1 Basic education

Basic education in Rwanda covers pre-primary, 6 years of primary and 3 years lower secondary education, the programme is a foundation for the Education Sector strategic plan (ESSP). The vision to set up basic education is to have every child in Rwanda access 9 years of free quality basic education (6 years in primary and 3 years in lower secondary (MINEDUC, 2010a).

The biggest challenge is however shortage of teachers across the country and this has resulted into a high student teacher ratio. Student teacher ratio stood at 57:1 in 1998 and it climbed to 74:1 in 2007. The ratio dropped a bit to 66:1 in 2008 but it is still considered high. To make matters even worse, many teachers are not considered qualified by the government, in 1998 the ratio of students to qualified teacher was 121:1, the ratio has fallen to 74:1, a clear improvement but still remains high. In addition to the short supply of teachers, there is a problem of too few schools and many of those lacking proper facilities. In the year 2000, a World Bank analysis found that 52% schools had classrooms in poor condition, 53% of the households were within 30 minutes walk to primary school (Bridgeland, Wulsin & McNaught, 2009). The situation has since been improving; the government started a programme of fast tracking 9 Years Basic Education (9YBE)[5] in 2009. A school construction programme commissioned by the government in collaboration with different stakeholders resulted in the construction of over 3,000 classrooms to accommodate an increasing number

[5] **9YBE**: Nine years basic education is a government of Rwanda programme to provide free quality education in the first nine years of schooling, i.e. six years of primary education and three years of general cycle of secondary education

of pupils. The government also removed the criteria for accessing lower secondary education on the basis of primary leaving examination (MINEDUC, 2010b). In 2009, there were a total of 2,432 primary schools and 2,264,672 pupils in primary schools in Rwanda (Republic of Rwanda, 2010)

### 1.3.2 Post-Basic Education

In Rwanda, Post-Basic Education (PBE) is education provided after basic education. This include; upper secondary, teacher education, Technical and Vocational Education and Training (TVET). Upper secondary education is 3 years of schooling and after upper secondary it depends on which level one joins, the length differ but higher education (University) is generally 4+ years (MINEDUC, 2010a)

The upper secondary education however face a challenge of lack of funds for investing into infrastructure to cater for more students from lower secondary, there is a big demand and pressure for upper secondary as a result of the implementation of 9YBE (MINEDUC, 2010a).

Another challenge that secondary schools face in Rwanda is gender parity, in 2008, there were only 92 females for every 100 male students. In 2008 there were 689 secondary schools in Rwanda, 68% public and 32% private, comparing the performance in both public and private, public schools perform better overall than private schools (Bridgeland, Wulsin & McNaught, 2009).

### 1.3.3 Tertiary Education

The first Higher learning institution was the National University of Rwanda (NUR) founded in 1963, the NUR continued to be a sole higher learning institution, NUR was made up of three schools at the start and enrolled 49 students in its first year, the enrolment gradually increased as years went on, in 1980, enrolment reached 912 students, in 1985, 1,572 students and 4,550 in 2009. In 1994, just before the genocide, Rwanda had 13 higher learning institutions. By 1999, nine new higher institutions of learning had been formed and 7 of the pre-war higher learning institutions had closed. In recent years the number of higher learning institutions has been growing considerably. Rwanda has now a total of 28 higher learning institutions countrywide, 15 public higher learning institutions and 13 private ones (Bridgeland, Wulsin & McNaught, 2009; MINEDUC, 2010b)

### 1.3.4 Challenges schools face in general

Rwanda has made considerable progress in a number of areas, especially given the challenges it faced following the 1994 genocide. In education the enrollment has increased rapidly at all levels in the last seventeen years. However, Rwanda's education system has a number of current challenges, lack of qualified teachers, high pupil-teacher ratio in primary, gender parity, high dropout rates and repetition rates, inequality and many orphans and children headed families (Bridgeland, Wulsin & McNaught, 2009).

## 1.4 Policy context of ICT in Rwanda Education system

Before 1994, access to education was biased on basis of ethnicity and region, after a1994 genocide that claimed over a million lives, the Government of Rwanda recognised that education is a key player in addressing these challenges, by first transforming education as a tool of peace, unity and reconciliation, second, developing enough and capable human resources for the social and economic development of the country and addressing challenges of lack of qualified teachers and shortage of teaching materials (MINEDUC, 2003). To address the above challenges the government developed Education sector policy. The Education sector policy, describes the government's primary objective for education as providing universal primary education by 2010 and later achieve Millennium Development Goals (MDG's) for education for all by 2015 (MINEDUC, 2003).

The Government of Rwanda (GOR) further recognises the role ICTs can play in accelerating the socio-economic development of Rwanda towards an information-rich and knowledge-based economy. On the basis of this acknowledgment, the Government committed itself to the implementation of a number of key policy initiatives aimed at facilitating and accelerating development, deployment and exploitation of ICTs within the economy and the society (RITA, 2006).

Government also acknowledges the importance of ICT as a tool to address the challenges in education and therefore ICT has been emphasised in Rwanda policy pronouncements like Vision 2020, Rwanda ICT Policy, Rwanda Education Sector Policy, National Science, Technology and Innovation Policy, EDPRS, ICT in Education Policy (MINECOFIN, 2000; RITA, 2006; MINEDUC, 2003 & MINEDUC, 2008b).

### 1.4.1 The Millennium Development Goals (MDGs)

The United Nations(UN) Millennium summit of heads of states and governments of September 2000 convened to adopt UN Millennium declaration and agreed on eight (8) MDG goals, eighteen (18) targets and forty eight (48) indicators on development and reduction extreme poverty by 2015. This study will base itself on goal eight which states that "In co-operation with the private sector, make available the benefits of new technologies, especially information and communications" (UN, 2010:71). Following this target of the MDGs, the NEPAD pledged to prioritise efforts to bridge digital divide between Africa and the rest of the world by introducing an initiative - NEPAD e-schools initiative whose main aim is to use ICT in education to improve quality and access to education among African member states (NEPAD, 2005).

One of the targets of MDGs is to achieve universal primary education and elimination of gender inequality by the year 2015. The role of ICT in education especially the early age in schools can accelerate this target by helping students to participate in today's information and knowledge society. A number of developing countries have set up initiatives for providing access to ICTs in their schools. For example the government of Rwanda together with its partners has started several initiatives to introduce computers both to primary and secondary schools in order to prepare students to participate in today's information world and to achieve Rwanda's vision of becoming middle income economy by the year 2020, using ICTs as an engine to accelerate socio-economic development of Rwanda. Some of these initiatives in Rwanda are the World Links initiative that provided refurbished computers and trained teachers in basic ICT skills. The initiative by the Ministry of Education to provide ten computers per secondary school both public and private in Rwanda, training of teachers in ICT and basic skills, the introduction of ICT as a compulsory subject in secondary school curriculum in 2007 and One Laptop Per Child (OLPC) initiative (Rubagiza, Were and Sutherland, 2011). Already 10,000 laptops are in use in primary schools in Rwanda and His Excellency President Paul Kagame expressed Rwanda's commitment during the launch of One Laptop per Child project in 2008, of up to 120,000 laptops in primary schools by 2012. The launch of NEPAD e-schools in Rwanda in 2006 which saw Rwanda as one of the African countries to benefit from the use of the NEPAD e-schools initiative, all these and other initiative clearly shows Rwanda's commitment to achieve the MDGs through the use of ICTs in education (MINEDUC, 2010 b).

### 1.4.2 Vision 2020

The Vision aspires to transform Rwanda into a middle-income country by the year 2020. The vision document states that "This will not be achieved unless we transform from a subsistence agriculture economy to a knowledge-based society." (MINECOFIN, 2000:3). The Vision also recognises the human capacity development, in the areas of education, health, and ICT skills, at all levels of the country's economy and emphasis on "infrastructure development, entailing improved transport links, energy and water supplies and ICT networks" (MINECOFIN, 2000:4) as the key pillars for transformation. It is further stated in the vision that Rwanda has to "facilitate the creation of high and intermediate technology enterprises and develop access to ICT down to the administrative sector level, in accordance with the national ICT plan" (MINECOFIN, 2000: 20). Finally the vision emphasises that "By 2020, Rwanda projects to have Internet access at all administrative levels, for all secondary schools and for a large number of primary schools…" (MINECOFIN, 2000:16).

### 1.4.3 Economic Development and Poverty Reduction Strategy (EDPRS)

The Rwanda Economic Development and Poverty Reduction Strategy (EDPRS) is both document and a process, it sets out the major objectives, priorities and policies for Rwanda's next five years (2008-2012). It provides medium term framework for achieving aspiration stipulated in Rwanda Vision 2020, the Millennium Development goals and the seven year Government of Rwanda programme (Republic of Rwanda, 2007). The EDPRS framework document provides a road map for the government of Rwanda, the development partners, private sector and civil society, the roadmap indicates "where Rwanda wants to go, what it needs to do to get there, how it is going to do it, what it costs to get there and how it will be financed" (Republic of Rwanda, 2007: 1).

As noted in EDPRS document and process, the ICT sub-sector is considered crucial; the document states the objective for the use of ICT sub-sector is:

> to promote investment in and the growth of the Information and Communications Technology industry. Efforts will be made to widen access to ICT among the population, and to promote ICT for e-Governance, education and capacity-building, and for use by the private sector (Republic of Rwanda, 2007: 59).

### 1.4.4 Education sector Policy

In order to attract foreign investors in the next 20 years, Rwanda should have positioned herself to be a regional service and ICT hub, in order to achieve that however, Rwanda needs to have an educated workforce, which require much investment in capacity development at all levels of education, "Without many natural resources to boast of, the strategic development of the service industry based on ICT is imperative." (MINEDUC, 2003:17).

The emphasis of promoting science and technology with special attention to ICT is one of the main objectives of the education sector policy that put ICT at "the heart of the education system" (MINEDUC, 2003:22).

### 1.4.4 National Science, Technology and Innovation policy

The national policy on Science, technology and innovation, states that building science and technology capacity in Rwanda is to educate her citizens in science and technology. The skills should be learnt from low to higher levels to enable Rwandans to participate actively in research aimed at Rwanda's development. ICT in education from primary to secondary and higher learning institutions is considered crucial in the policy. "The use and integration of science, computer literacy shall be promoted and popularised in schools and in our various workplaces and that publications, studies, investigations and reports shall be promoted in the ICT sector." (Republic of Rwanda, 2006:15)

### 1.4.5 NICI policy and plan

Rwanda ICT for Development (ICT4D) process started in 1998 with the support of the Africa Information Society Initiative (AISI) of the United Nations Economic Commission for Africa (UNECA), the process aimed at facilitating Rwanda's socio-economic development through the deployment and exploitation of ICTs within Rwanda's economy and society. Rwanda published its National ICT policy-NICI (National Information and Communications Infrastructure) in 2000; this policy was based on a document that was released in 1999 for the national debate the ICT-Led Integrated Socio-economic Development Framework (RITA, 2006).

The NICI policy and plan is being implemented in four phases (5 year rolling plans). NICI plan one (2001-2005), NICI plan Two (2006-2010), NICI plan Three (2011-2015) and NICI plan Four (2016-2020). Every phase of the NICI plan has a goal to accomplish up until

Rwanda 2020 when Rwanda aspires to transform itself into a middle-income country (RITA, 2006).

The NICI-plan elaborates clearly the integration of ICTs in Education. The policy emphasise the use of education software and translating the software into local Kinyarwanda language, as a strategy to avail relevant and quality of education, the policy points out the development of e-learning content and teacher professional development in the area of ICTs in education, the acquisition of computer equipment for schools and the national School Net project to provide access to the Internet for schools are among other policy action items (RITA, 2006).

The Rwanda ICT policy aims to achieve the development of education initiatives for academic exchanges, implementation of ICT in schools using the Smart school concept as a technology platform for distance education and integration of ICT use in rural schools (RITA, 2006 & Farrell, 2007). This falls squarely in the NEPAD e-schools initiative.

It is clearly stated in the NICI policy that the implementation of the above mentioned policy action items will have a very significant impact on the development of the key sectors of the economy. "The development of the Rwanda information and knowledge economy will depend heavily on how much its resources are invested into promoting the deployment, utilization and exploitation of ICTs in the Educational Systems" (RITA, 2006 :81)

### 1.4.7 ICT in Education Policy

In order to fulfill the implementation of NICI planned actions, MINEDUC tabled a draft ICT in education policy in 2008. The Policy states the education sector mission as "creating a shared understanding for integrating ICT at all educational institutions, at all levels, to support the development of better teaching and learning to equip students with the 21st century skills" (MINEDUC, 2008b:17). ICT in Education policy is mandated to further facilitate the training of both primary and secondary school teachers in integrating ICTs in teaching and learning. It is expected that ICT in Education Policy will guide the implementation and integration of ICT in education. (Rubagiza, Were and Sutherland, 2011).

## 1.5 Efforts to provide schools with ICT in Rwanda

Rwanda has established partnerships with a number of organisations internationally, regionally and nationally to provide access and use of ICT in education system in Rwanda. The government through Ministry of Education is determined to design and implement ICT

in education programmes, in that effort, ICT infrastructure has been provided to both primary and secondary education, the efforts to coordinate all these programmes and initiatives are being done by an ICT unit in the Ministry of Education (Rubagiza, Were and Sutherland, 2011). Some of these initiatives and programmes are: The World Links initiative, an American NGO in collaboration with Ministry of Education, the project provided refurbished computers (400 computers in 20 secondary schools and 196 laptops to primary schools with electricity and trained teachers in basic ICT skills in early 2000s, The Rwanda Ministry of Education initiative to provide ten computers per secondary school both public and private in Rwanda, by the end of 2006, 210 out of 400 secondary schools in Rwanda had received ten computers each, training of teachers in ICT and basic maintenance skills, the introduction of ICT as a compulsory subject in secondary school curriculum in 2007 and recently the launching of One Laptop Per Child (OLPC) initiative (Rubagiza, were and Sutherland, 2011). The Give One Get One[6] participants donated 10,000 laptops to Rwanda and they are already in use in different school in Rwanda, His Excellency President Paul Kagame expressed Rwanda's commitment during the launch of One Laptop Per Child project in 2008, of up to 120,000 laptops in primary schools by 2012 (MINEDUC, 2010b)

The Global centre for excellence[7] in Laptops and learning was opened at the Kigali Institute of Science and Technology (KIST). The center's main purpose is to give support to the ongoing implementation of laptops in Rwanda primary schools, to create quality learning environment with connected laptops in schools and creating laptop network for the Africa region in Rwanda (MINEDUC, 2010b)

### 1.6 Identification of the problem

Education is vital as it enhances people's skills and knowledge and improves standards of living by offering better opportunities for jobs. The government acknowledges the importance of ICTs in education and therefore ICTs has been emphasized in most of Rwanda's policy pronouncements including Vision 2020, Rwanda Education Sector Policy and Rwanda ICT policy (MINECOFIN, 2000; MINEDUC, 2003; RITA, 2006).

[6] Give One Get One is a programme by OLPC of purchasing two XO laptops – give one to empower a child to learn in a developing nation, and give one to your child.

[7] Global centre for excellence in laptops and learning is a centre created by OLPC at Kigali Institute of Science and technology in Rwanda to provide support in implementation of laptops in schools.

The NEPAD e-schools programme has made efforts in terms of providing access to ICT facilities in Rwandan schools. Research in the field of ICT integration schools reveal that ICTs are essential tools in present information and knowledge economies and have been found to make significant changes in the way we live. ICTs mostly computer technology have become important tools for teaching, learning and means of widening access to education opportunities (Bauer & Kenton, 2005; OECD, 2001). However, access to ICT facilities does not imply usage and (any) usage does not mean effective usage is happening. Mere introduction of technology to the educational process is not enough. There are other factors that needs to be considered for the effective integration of ICTs in schools, studies have found factors such as policy development, planning, leadership, curriculum alignment, funding, professional development, technology use, teacher openness to change, personal access for teachers, teacher technological competency and confidence, teacher students' attitudes as among other factors that influence the level and effectiveness of ICT integration in schools (Baylor & Ritchie, 2002; Han, 2002; Kozma &Anderson, 2002; OECD, 2001; Pelgrum, 2001; Schiller, 2003). The problem being investigated in study is to consider effectiveness of ICT in schools by looking at strategies to overcome barriers found in this present study and those barriers discussed in the literature review. This study on the implementation and integration of ICTs as tools for classroom instruction in Rwanda NEPAD e-schools is conducted because there is no any other study of such kind in Rwanda and therefore there is no evidence on strengths and weaknesses of the e-schools approach. Lack of information on the use of ICTs in NEPAD e-schools therefore led to the present study.

### 1.7 Scope and delimitations

This study focused on Rwanda NEPAD e-schools only. Only three schools were involved in the study out of six NEPAD e-schools in Rwanda. A study of all six e-schools would have given reliable and reasonable information and had the size and scope of the study been bigger, the study would have had more broader and comprehensive description of the issues under discussion. The results and conclusion however can be generalised to the all NEPAD e-schools. The purpose of the study was to investigate how lessons from the NEPAD e-schools project are useful for the Rwanda ICT in education policy and Rwanda ICT policy, the study focuses more on how the use of ICTs in schools can be properly planned and less emphasis on pedagogical integration of ICT in schools. The study of all six NEPAD e-schools and the study of pedagogical integration of ICT all schools demanded more financial resources and time in terms of data collection, analysis and transcription. An important area for future

investigation, which was beyond the scope of this study, is the need for broadband infrastructure to support e-education.

Since this study involved only assessment of NEPAD e-schools in Rwanda, the scope of the departure and timeline of the study is from the NEPAD e-schools project launch in Rwanda in 2005 to the time of this research in 2011.

### 1.8 Outline of the study

This research report is organized into six chapters:

**Chapter One:** This chapter presents orientation of the present study. The chapter gives a background of NEPAD e-schools; it provides Rwanda education context and policy context related to the use of ICTs in schools and efforts the country has taken in equipping schools with ICTs. The chapter concludes by providing problem identification and purpose of the present study.

**Chapter Two:** This chapter provides a review of relevant literature on prior studies in the field of introduction and integration of ICT in schools. It presents the importance of ICT in schools and society; it identifies factors for and against the use of ICT in schools, discusses the impact of ICTs in schools and concludes with problem identification of the current study.

**Chapter Three:** This chapter describes the research methodology that guided this study. The chapter justifies the research paradigm chosen, discusses the research design approach. This is followed by procedures used in selecting participants, the sampling and the data collection methods and instruments are mentioned and explored, a description of analysis of data collected, ethical issues and arguments for reliability and validity are given and the chapter concludes with limitations of the current study.

**Chapter Four:** This chapter presents research findings from interviews conducted in three case study schools. It also report findings from learner's focus group interviews and documents related to the use of ICTs in schools.

**Chapter Five:** This chapter presents analysis of research findings on the use of ICTs in case study NEPAD e-schools, and shows how they relate to research questions and literature review.

**Chapter Six:** This chapter gives an overall conclusion of research findings, proposes recommendations for policy and practice and offers recommendations for future research.

## Conclusion

This chapter provided background to NEPAD e-schools programme and Rwandan case study. The chapter also provided Rwanda education context, it further provided policy context related to the use of ICTs in schools and efforts the country has taken in equipping schools with ICTs. The chapter concludes by providing purpose of the present study and structure of this research report.

# CHAPTER TWO

# EXPLORING THE ARGUMENTS IN THE FIELD OF ICTs IN SCHOOLS

## 2.1 Literature review

The current trends in the development of technology and the willingness of the NEPAD to integrate ICTs into African schools (the NEPAD e-schools) led to a review of the current literature regarding the introduction of ICT into schools. This chapter reviewed the literature that identifies the definition main terms used, importance and use of computers in schools, factors that influence the use of computers in schools, barriers of ICT integration in schools and the impact of computers for learning and teaching practices.

### 2.1.1 Definition of terms

#### 2.1.1.1 Information and Communication Technology (ICT)

Tommey (2001) refer to Information and communication technology (ICT) as "those technologies that are used for accessing, gathering, manipulating and presenting or communicating information. The technologies could include hardware (e.g. computers and other devices); software applications; and connectivity (e.g. access to the Internet, local networking Infrastructure, videoconferencing)" (Tommey, 2001:1).

#### 2.1.1.2 ICT integration

According to Earle (2002), integration is bringing together elements of teaching and learning process and technology, integration therefore includes "a sense of completeness or wholeness and incorporates the need to overcome artificial separations by bringing together all essential elements in the teaching and learning process—including technology (as *one* of the elements, not the sole element)"(Earle, 2002:15).

ICT integration is therefore putting together ICT and integration and ICT integration is therefore defined as a process of using ICT tools (computers, digital cameras, interactive white boards, online materials, multimedia content, content on CD-ROMs and other tools) to enhance teaching and student learning (Wang &Woo, 2007).

#### 2.1.1.3 E-school

An e-school is defined as "a school connected to the ICT network and with a minimum set of ICT tools and teaching capabilities necessary to impart ICT skills and improve the provision of education in Africa". (Kinyanjui, 2003:5).

NEPAD e-schools concept framework document define an e-school as one that is connected to the internet with appropriate set of ICT infrastructure, access to appropriate teaching and learning materials, ICT tools to enhance administration and management and trained teachers in ICT to provide skills necessary for education in schools (NEPAD, 2004).

### 2.1.2 The importance of ICTs in schools

ICT skills are demanded by employers in all sectors of the economy and in many institutions and many claim that one cannot be productive in the 21st century workplace without ICT skills; hence these skills should be learnt at early age in schools. Research shows that ICT skills will be a prerequisite for school leavers to work in all sectors of the economy and therefore schools should be prepared to provide these skills to their students before they leave school so that they can be able to work in today's information and knowledge world (Trucano, 2005). Therefore countries and institutions all over the world have started to use ICT's in schools. Yelland (2001), argue that the traditional education environments do not seem to favour learners to be productive at work in today's technology world, neither will they be able to function in workplaces of today's society. She goes on to claim that institutions or organizations that do not incorporate ICTs in schools should not consider themselves as preparing their students for the twenty-first century skills for their own life and that of the society they live in (Yelland, 2001). This argument is supported by Grimus (2000), who pointed out that " by teaching ICT in primary schools the pupils are prepared to face future developments based on proper understanding" (Grimus, 2000:36). This is further emphasised by Cook and Finlayson who argued that without skills and knowledge in the new ICTs, youth may not be able to gain the advantages of employment in the 21$^{st}$ century information era, therefore the role of ICTs in Schools is essential (Cook & Finlayson, 1999). Similarly Bransford, Brown & Cocking (2000) reported that "What is now known about learning provides important guidelines for uses of technology that can help students and teachers develop the competencies needed for the twenty-first century" (Bransford, Brown & Cocking, 2000:206).

Computers are seen worldwide as essential tools in education, but it is worth examining the importance and use of computers in schools. Hokanson and Hooper noted that: "Despite a history of achieving only marginal benefits from using technology in education, many schools and other educational organisations are investing heavily in computer technology" (Hokanson & Hooper, 2000:537). In the researcher's view, though there are problems and challenges around the implementation of ICT in schools, computers are still important for schools considering the continued investment and implementation of computers in schools by both the developed and developing world. The researcher agree with Chapman (1998) who emphasises that computers are important in education of a child, because the demand for the use of ICTs and need for more information is rapidly changing and ever increasing, learners should be well equipped with present and past information so that they can be better employees/citizens of this information and knowledge world, information is very important and computers have the capacity to record, store, process and make the information available to anybody, anytime and anywhere. Computers with other technologies can provide students with these opportunities at very young age at school to enjoy learning, make learning more interactive to the community and fellow learners. Computers are part of our daily lives, in shopping cashiers use barcodes, in banking we use ATMs (Automatic Teller Machines) and all these activities use computer programs, therefore is crucial that students get equipped with these skills and knowledge before leaving school.

Hawkridge, Jaworski and McMahon (1990) discuss the four reasons why computers should be used in schools, they identified these reasons as social rationale, vocational rationale, pedagogical rationale and catalytic rationale.

The social and vocational rationale prepare learners for industrialised, technological and knowledge world, in social rationale learners are trained to be computer literate to enable them participate in the industrial and knowledge world and in vocational rationale learners are prepared for future jobs through computer training (Hawkridge Jaworski & McMahon, 1990). The pedagogical and catalytic rationale deal with implementation of computers in classroom, pedagogical rationale enhances teaching and learning through the integration of computers into the curriculum and catalytic rationale, sees the learner becoming independent from the teacher in using computers (Hawkridge Jaworski & McMahon, 1990).

The South African Department of Education White Paper on e-Education (DoE, 2004:14) claims: "ICTs can advance high order thinking skills such as comprehension, reasoning, problem-solving and creative thinking and enhance employability."

Rwanda National ICT policy and plan- the NICI plan elaborates clearly the integration of ICTs in Education, following the national ICT plan, Ministry of education tabled an ICT in education policy which is still in a draft format, the policy emphasises the development of ICT in all sections of education, formal and non-formal, access and equity to education, access to infrastructure and support, access to content and development of ICT curriculum, sustainability, monitoring and evaluation and research and partnerships with relevant stakeholders (MINEDUC, 2008b)

### 2.1.3 Importance of ICTs in society

#### 2.1.3.1 Access to information

In today's information and knowledge society, the role of ICTs is very crucial and ICTs are a necessity if one is to take part in the today's knowledge based and globalised market economies (Avegerou, 2001). The integration of ICTs in the today' world of information and knowledge economy is essential and has reduced obstacles brought about by distance and time. ICTs has also been accredited for encouraging investment, making trade in goods and services easier, employment creation and increasing revenue (Carayannis & Popescu, 2005). This can be seen in all sectors of economies of both developed and developing, ICTs are providing access to information, people are employed in ICT projects and companies and hence increasing their income which leads to poverty reduction. People can communicate at distant places by sending e-mails; people can shop on line reducing travel and transaction costs. However, this is only done by few individuals; governments should encourage investment and participation in the field of ICTs through partnerships with different stakeholders in the area of ICTs.

#### 2.1.3.2 Provision of employment opportunities

ICTs are essential for the work environment, every employer is looking for an ICT skilled employee, without ICT skills in this 21st century world, it is practically impossible to be employed anywhere, so ICT skills must be an integral part of schooling and should be introduced earlier in schools (Pelgrum,2001).

#### 2.1.3.3 Facilitate Socio-Economic development

Meng & Li (2002) emphasised that the role of ICTs in economic growth and development in developing countries is not clear; they claim that developing countries lack human capacity in terms of knowledge, they lack capital to invest in ICT projects and programmes, so they are incomparable with industrialised countries which have huge amount of investment both capital and human. That's why developing countries are lagging behind both in the diffusion and integration of ICTs. However, Wong argues that it would be advantageous for the developing country to leapfrog from the ICTs adoption experiences from the industrialised nations, this experience enables developing countries not to reinvent the wheel, so they can adopt to technologies that are already in existence, they can directly experiment the new technologies without incurring costs of adopting new technologies that has already been developed by developed countries (Wong, 2002).

Rwanda's ICT vision is to transform Rwanda from Agriculture based economy to knowledge based economy and society by the year 2020 by using ICTs as enabler. The Government of Rwanda (GOR) recognizes the role that ICTs can play in accelerating the socio-economic development of Rwanda towards an information-rich and knowledge-based economy. On the basis of this acknowledgment, the Government committed itself to the implementation of a number of key policy items and initiatives aimed at facilitating and accelerating development, deployment and exploitation of ICTs within the economy and the society (RITA, 2006). The NICI plan sets out sub policies for every sector of the economy and how the subsector will benefit the society using ICTs.

### 2.1.4 Factors affecting the use of ICT in schools

Studies on the factors that influence the use of computer technology have shown positive effects on the use of computer technologies in schools and on pupils' learning. However, other studies came up with criticisms and raised concerns about the effective use of computers in schools (Cuban, Kirkpatrick & Peck, 2001; Robertson, 2002). Though there are challenges in the use of ICTs in education but there are a lot of benefits in integration of ICTs in education. The following literature helps us examine the problem.

### 2.1.4.1 ICT Policy and vision

According to Baylor & Ritchie (2002), there are many factors that need to be taken into account when integrating computers into the school system. They consider Policy development, planning, leadership, curriculum alignment, professional development, technology use, teacher openness to change, teacher nonschool computer use, technological competency and technology integration, and teacher students' attitudes as factors that influence the level and usefulness of computer use in the schools. They also consider the areas of teacher skill, teacher morale and perceived students' learning as factors requiring consideration.

The importance of having ICT policies in education is seen by most governments around the world as essential to the successful integration of ICT in education. Kozma and Anderson state that most governments have developed ICT in education policies and have invested a lot in providing access to ICTs in schools.

> "Countries … have all set national goals and policies that identify a significant role for information and communication technologies (ICT) in improving their education systems and reforming their curricula. Major investments have been made to increase the numbers of computers in schools and the networking of classrooms. Most countries, however, have a relatively small number of schools and teachers who are taking the lead in using technology to make changes in pedagogical practices that prepare students for the future" (Kozma &Anderson, 2002:1).

The vision of a country is critical in any implementation of an innovation, if you have a good vision, supported by clear and comprehensive ICT policies and plans, school ICT policies and plans will be implemented effectively, national ICT policies should guide and inform school level policies on how to plan and provide road map to schools in implementing ICT in schools. Farrell and Wachholz noted that a key element of implementing and integrating ICT in schools is providing favourable national policy framework, they state that:

> "Policies are an important ingredient of any leadership and management process…. A policy framework provides a vision of a desired end outcomes, it defines the results that need to be achieved in order to reach those ends, and provides guidelines for how the results are to be achieved" (Farrell & Wachholz, 2003:266).

Researchers in the area of ICT's in schools have pointed out that a school's ICT vision is essential to effective ICT integration (Anderson & Dexter, 2000). Ertmer (1999:54) stressed

that, “A vision gives us a place to start, a goal to reach for, as well as a guidepost along the way”. Before substantial investments are made in schools hardware and software, Means & Olson (1997) recommend that schools and teachers should develop a vision.

#### 2.1.4.2 ICT school leadership

Effective leadership is essential factor if a new innovation and implementation of change in schools is to happen (Calabrese, 2002). Anderson and Dexter argued that although technology infrastructure is important, ICT technology leadership is even more necessary (Anderson & Dexter, 2005). Therefore school principal is the key to realize the potential of ICTs in schools; they act as special agents of change and main supporters of all innovations (Schiller, 2003; Han, 2002).

Research has shown that the vision, leadership and management of an institution enable the institution and its members to use ICTs more effectively than their counterparts where the management and leadership are poor (Czerniewicz & Brown, 2009). In institutions where management is top-down with little collaboration between management and staff, staff members feel obliged to use ICTs and therefore do not use it productively, they feel constrained, unsecure by lack of institutional support and they do not feel the purpose of ICT use (Czerniewicz & Brown, 2009).

#### 2.1.4.3 Funding ICT implementation in schools

Effective integration of ICTs in schools require a sound financing policy frameworks for procuring appropriate hardware and software, acquiring teaching and learning tools, carry out the professional development of teachers, install and pay for Internet connectivity, upgrading, maintenance and replacement of hardware and software. However, other factors come into play when effective integration of ICT in schools is to happen, teaching and learning environment has to be conducive, school leadership has to be supportive and teachers and students should have positive attitudes towards ICTs (OECD, 2001; Cawthera, 2001; UNESCO Bangkok, 2004). UNESCO Bangkok further stressed that financing of ICT integration is important but it has to go hand in hand with other factors. “Management and financial strategies for effective ICT integration in education must take into account a wide range of factors, including events, activities, contents, and interpersonal processes that are within the context under which ICT is used.”(UNESCO Bangkok, 2004:59)

### 2.1.4.4 Access to Infrastructure

ICT infrastructure involves acquiring and installation of hardware and software systems, here resources such as computers, local area network, Internet connectivity and appropriate software should be acquired and installed, the decision to choose which hardware and software to use is also at this stage. If schools have ability to provide reliable access to technology for teachers and students, then the integration of computer technology is more effective in schools (Salmon, 2004).

The available ICT resources is a factor that affect the ICT use in schools, Pelgrum (2001) stressed that the ratio of students to ICTs facilities available as a factor that results in less exposure to ICTs per student and hence one student may dominate using computers while others keep on watching, this dominance, Pelgrum argues may lead to inefficient teaching and learning since computers are not used evenly therefore all students may not get equal access (Pelgrum, 2001) available ICT resources is a factor that affect the ICT use in schools, Pelgrum (2001).

Teachers and students socio-economic context may affect the ICTs use at schools, the socio-economic context brings a divide, in wealthy families, many students have access to ICTs at home, therefore they have skills and confidence to use these ICT technologies at schools (Muller, Sancho & Hernandez (2007) and in poor families students do not have these facilities. These disparities, Bovee, Voogt & Meelissen (2007) argue that bring inequality and confidence issues in use of ICTs in schools. To ensure that teachers and students have timely access to ICT equipment at schools, schools should employ more than one person to manage and supervise ICTs so that teachers and students can easily find a person who can help them have access to ICTs anytime they want.(Miller, Naidoo, van Belle & Chigona, 2006)

### 2.1.4.5 Training and professional development

The role teacher's play in teaching and learning paradigm is critical, with ICTs enabling the development of cognitive skills in examining problems, evaluating arguments and applying what is learnt (UNESCO Bangkok, 2004). Although teacher's role is crucial in teaching/learning process, their roles are often ignored under these changing circumstances and are often not consulted when deciding changes in teaching/leaning process. In reality, under these changing circumstances, teachers needs have to be assessed and find solutions to

satisfy these needs. For the effective use of technology to improve their teaching and learning practices, professional development of teachers is important (UNESCO Bangkok, 2004).

Afshari, Bakar, Su Luan, Samah and Fooi, (2009) support the importance of teacher professional development and suggest that for any effective technology integration in education, teacher professional development is central and teachers can only integrate technology into their teaching courses when professional ICT training gives them time to practice with ICT to teach, learn, collaborate and share with their colleagues (Afshari et al., 2009). The need to provide teacher professional development in ICT on a continuous basis was stressed by OECD (2001) emphasising strongly that without teacher professional development in ICTs on a continuous basis, "effective technology integration into schools cannot succeed" (OECD, 2001:16)

Many countries have recognised the importance of ICT in teaching and learning and they have planned and provided ICT training for teachers in different forms. Although many teachers complain that the training provided to them is not adequate to prepare them to use ICT effectively in teaching and learning, there is consensus that countries around the world seem to have made efforts to use technology to train teachers in ICTs and train them in using ICTs as tools to enhance their teaching and learning (Jung, 2005). Baylor and Ritchie carried out a quantitative study and found that teacher professional development was found to have major influence on the best use of ICTs in the classroom. They however found that teacher trainings in ICTs often focus on ICT basic literacy skills and less on using ICT as tools to enhance teaching (Baylor & Ritchie, 2002).

Teacher's attitudes towards computer usage and their access to effective training and help is fundamental in initial stages of implementing ICT in schools, in implementing ICTs in schools environment, teacher's interest in using technology and amount of time available to them should be considered (Salmon, 2004). According to Carlson (2002), experience in ICT integration into education around the world has shown that teacher professional development in the use of technology in schools is a key factor in student acquisition of knowledge and skills and has therefore improved student performance. Carlson further stresses that for technology to transform education it requires teachers who can apply technology into their teaching programmes and use it to improve their student learning experiences, in other words technology cannot be effective on its own; it needs trained teachers who can appropriately and effectively integrate it into their teaching plans (Carlson, 2002).

### 2.1.4.6 Adequate and reliable and ongoing technical support

One of the critical factors for the effective implementation of ICT in schools as Seyoum (2004) argue, is to provide effective technical support to schools. In order to guarantee efficient and effective implementation and integration of ICTs in schools, technical support should be an integral part of schools overall school plan, the plan should include installing hardware, operation, hardware maintenance, security and administration of network and supporting the whole school and teachers, no matter who provides the support, be a trained staff from within the school or external technical provider or both, in-school technical support is essential for sustaining ICT in any given school (Seyoum, 2004). OFSTED conducted a study in Britain and discovered that professional and technical support was more efficient in schools where schools strategic ICT plan integrated the element of technical support and where the educators and technical support personnel had a good relationship (OFSTED, 2004).

Information Technology (IT) requires support staff to help in maintenance and troubleshooting of hardware and software, ongoing teacher professional development in the use of ICT for teaching and lesson planning and delivery. Microsoft Blueprint noted that: "Support services should be deployed that are both affordable and effective, and meet the needs, of staff and students within the school" (Microsoft, 2005: 11). This is further stressed by GeSCI (2009) that: "All users should also be provided with on-going support in using the technology platforms, content and applications" (GeSCI, 2009:9).

### 2.1.4.7 Content development and curriculum alignment

Computers should be deployed with appropriate content and software applications to meet the needs of students. Curriculum should march the requirements, needs and priorities of education. Computers should have basic software like word processors and spread sheets, administration software tools like accounting and education management software and electronic content like e-books. GeSCI (2009) stressed that "Deploying ICTs without the appropriate content, software and applications is like buying a car without fuel" (GeSCI, 2009:8). GeSCI (2009) identified four categories of content and software applications depending on the subject or class to be addressed. Basic software, like word processors, spreadsheet programmes, presentation software and Internet browsers and email, school administration applications tools such as accounting and time tabling applications and Educational Management Information Systems (EMIS), educational applications, like

programming tools for children, simulation software, quizzes and assessment applications and electronic content, which includes e-books, journals, e-lesson plans, dictionaries, encyclopedias, teaching guides and multimedia content. (GeSCI, 2009).

#### 2.1.4.8 Time

For the successful implementation of ICTs in schools, availability of adequate time is critical, teachers need time to master the use of ICTs and generally teachers have little time for planning and prepare the use of ICTs, the time they have is for providing instruction and therefore school administrators must provide more time to teachers to become effective ICT users (Wanjala, Khaemba & Mukwa, 2001). They further said that teachers who begin using ICTs said that it creates more work for them and therefore they need more time to use ICTs in schools. To adapt a new innovation, implementers need more time to learn new knowledge and skills, implementers must also have time to adapt and integrate new innovation. The acceptance of an innovation itself does not bring about change, time is crucial for people to understand, adapt and develop abilities to use the innovation (Ely, 1990). Ely further claim that time is a resource, for the new innovation to be effective, time to use, integrate and adapt a new innovation is necessary (Ely, 1990)

#### 2.1.4.9 Government/private sector/community involvement

Partnerships are very important in every setting; developing countries which are ambitious in implementing ICT in schools programmes and cannot afford to fund all the ambitious projects should seek for partnerships. Partnerships can be in all areas depending on which component you are not able to fund or you do not have the capacity and expertise to do it yourself. For example developing countries have been in partnerships with international recognized IT companies (Microsoft, Cisco, Intel...) and they have been getting great support. Governments agencies and donors have been at the forefront in investing into ICT in education projects, when these initial investments are made, they are often left to schools to take care of maintaining and expanding these systems, schools need to source funds for maintaining these computers, buy and update new software as need arises, schools need to pay for Internet access on monthly basis, they need to maintain the salary to technical staff and instructors to maintain these computers and train teachers and students respectively, therefore schools need to modify their existing budgets to cater for these needs (Rusten, n.d). Rusten further pointed out that mechanisms of revenue generating activities should be developed by schools in order to raise funds for ICT in education projects, he said these

revenue generating activities which could include computer training to public, providing computers to the community members and government agencies to access their computers on fee for use basis can be done after normal schools hours, these activities can generate income to maintain their computer systems and can create a good relationship with the community. These relationships between school, community and private sector partners can lead to longer term financial, political support and access to needed support (Rusten, n.d)

#### 2.1.4.10 Monitoring and evaluation

For ICT in education projects to be successful and sustainable, Rusten pointed out that monitoring and evaluation is fundamental. He further stressed that monitoring and evaluation activities can be organized in two parts, first part is project implementation and the second part is project impacts (Rusten, n.d). Monitoring and evaluation mechanisms should be in place so that improvements in policy and implementation can be reviewed and improved upon.

### 2.1.5 Barriers for ICT use in schools

Studies have approached barriers for ICT use without placing emphasis on whom or upon what these impeding factors could be attributed. A study by Keengwe, Onchwari & Wachira (2008) categorize these barriers to technology integration into first-order or second-order barriers. First-order barriers include lack of equipment; unreliability of equipment; lack of technical support and other resource-related issues and second-order barriers including both school level factors, such as organizational culture and teacher level factors, such as beliefs about teaching and technology and openness to change.

In their study of the factors that prevent teachers from integrating computers in their lessons, Loveless, Williams and Kutnick (2000) considered factors like, lack of resources and materials, the pressure of time, the insufficient or the inflexible guidelines, the standards of curricula, the lack of support or recognition for integrating computers, and the inadequate training and technical support. This study discusses into more details the most common barriers that were identified in the previous studies

#### 2.1.5.1 Lack of confidence and skills

Many teachers are anxious and not confident in using ICTs in front of students who perhaps they think are more skilled than they do, those teachers who consider themselves unskilled or

not well skilled will try to avoid using ICTs in front of students. Lack of confidence was also echoed by British Educational Communications and Technology Agency (BECTA (2004)) in research on barriers for uptake of ICTs by teachers, it was found that low confident teachers in the use of ICTs will always expect things going wrong and therefore may avoid using ICTS, also a teacher with low ICT confidence may refuse to take part in trainings probably because of fear to be embarrassed in front of colleagues (BECTA, 2004). Students who have access to ICTs experience daily use and interaction with new technologies, put pressure and demands on teachers, expecting them to be knowledgeable in the area of ICT usage. This is a barrier for teachers who may be less skilled and confident in using ICTs in front of students and may choose to avoid using ICTs (Guha, 2000).

Confidence in the use of computers and lack of computer skills by students is another obstacle that was found in the study by Frank, Reich & Humphreys (2003), they found that some students were struggling with technical difficulties; lack of computer skills which makes them became afraid of touching the computers. Teachers support to student's use of computers is important for the learners to understand the use of computers in classroom context. Teacher's guidance is seen by Baylor and Ritchie (2002) as an important contribution for learners to improve their performance using computers, both in learning skills and involving them in other activities.

### 2.1.5.2 Attitudes towards ICT

Teachers and students attitudes towards computers are the most important barrier to the successful implementation of computers in the classroom (Lee, Hong & Ling, 2002; Veen, 1993). Lee et al. (2002) in their study reported that to prepare students psychologically for ICT use in classroom, students should have positive attitudes toward computers, they presume that creating an opportunity for those involved in the use of computers and providing them with conducive environment for the use of computers will lead to students having positive attitudes towards their use.

### 2.1.5.2 Insufficient facilities

Evidence demonstrate that schools with enough and good quality ICT resources, demonstrate a good practice in the use of ICTs (Mumtaz, 2000), and absence of good quality software and computers can limit what teachers and students can do with ICTs in classroom. The study by BECTA highlights the importance for schools to be well equipped with enough and good

quality ICT resources. The research investigated relationship between ICT use in schools and pupils achievements in national examinations and found that schools that were well resourced in ICTs outperformed those schools that were not well resourced with ICTs (BECTA, 2003).

#### 2.1.5.4 Lack of personal access

Ross, Hogaboam-Gray & Hannay, (1999) pointed out that in discussing the issue of access to ICT resources, there is a need to link the access teachers need to teach with ICTs and teachers personal access to ICTs to allow teacher plan and prepare their lessons, the amount of personal access to ICTs for example teachers access to laptop at home raises teachers confidence. The relationship between personal access to ICTs and teachers confidence was also found by (Guha, 2000; Cox, Preston & Cox, 1999), the result of their study showed that teachers who were regular users of ICTs demonstrated more confidence in using ICTs and as a result they develop positive attitudes towards ICT, they develop less fear in using ICTs and see ICTs as a valuable tool for both their own personal use and for teaching purposes.

#### 2.1.5.5 Insufficient technical support

Teachers anxiety that something might get wrong during the process of using ICTs is a major barrier that prevent teachers from using ICTs, when a teacher expects technical faults with ICT equipment and does not have any available technical support, the teacher will have less confidence in using ICT for teaching and this may cause teachers to avoid using ICTs in future (Bradley & Russell, 1997). The issue of technical support is further emphasised by Snoeyink and Ertmer, they found out that while trying to use a computers and cannot do the task they intended to do due to technical problems, teachers would then avoid using the computer, this therefore underline the need for availability of qualified and competent technical personnel in schools to carry out technical support on a permanent basis (Snoeyink & Ertmer, 2001)

#### 2.1.5.6 Insufficient time

A barrier that prevents teachers to make full use of ICT is lack of sufficient time needed to fully accomplish their teaching tasks; they lack time to prepare lessons, lack time to research teaching materials (Fabry and Higgs, 1997). Fabry and Higgs further pointed out that new skills like learning technology requires time and yet teachers have a lot of tasks to do at schools like lesson preparation, teaching, attending staff meetings, raising with other staff and

parents and therefore are left with little or no time to experiment with ICTs (Fabry & Higgs, 1997).

Evidence of lack time by teachers to use technology is provided by Cuban, Kirkpatrick and Peck (2001) in their survey of teachers, they found out that teachers lacked time to use ICT fully into their teaching; teachers said that they needed hours to prepare lessons by searching materials on websites and multimedia materials and to undertake trainings. This problem did not apply only to teachers who do not use technology very often but similar complaints applied to those teachers who attempted to make full use of technology into teaching, as they had to work long hours in order accomplish the successful integration of technology into their lessons (Cuban, Kirkpatrick &Peck, 2001).

### 2.1.6 Impact of ICT in schools

Studies that favour ICT integration into schools argue that ICTs can significantly improve students' performance and can make the school administration function better, studies further claim that there are factors responsible for these improvements and stated those factors as; learners having access to information and hence education, improving whole school and classroom administration, preparing learners and teachers for information and technology world and supporting new pedagogy practices (Jordan, 2005; Watson, 2001).

#### 2.1.6.1 Teaching

Teachers are critical in any effective and successful integration of ICT in education initiative, without dedicated teachers prepared and eager to learn and adapt new innovation like the use of ICTs into teaching and learning, the initiative is likely to fail. Findings by Chapman & Mahlk (2004) concur that using ICT in teaching motivates students to learn, make students lessons more fun and increased children's autonomy and provided children the capacity to learn on their own pace. Teachers also perceived the use of ICT as a strategy that has reduced their administrative work and made teaching more interesting to them, ICT has provided teachers with tools for teaching and children's learning and this has made teachers work more of a facilitator rather than that of instructor (Chapman & Mahlk, 2004).

#### 2.1.6.2 Learning

Results from SAIDE study also reveal that ICTs provide learners with confidence and empowerment. Learners have developed love for the school, Students have learnt to work

independently rather than waiting to be helped and fed by the teacher. ICTs enable learners to think critically, it prepares learners to develop life-long learning habits. ICTs also help learners to access and synthesise information, evaluate and communicate the information and this prepares them for the 21st century world (Bialobrzeska & Cohen, 2003). Another impact of ICTs according to Cawthera is that ICTs make learning resources available to learners because of its ability to connect people; this makes access to education possible by connecting people and making learning resources available. In developing countries particularly African countries where qualified teachers are scarce, the availability of ICT resources can be of great benefit (Cawthera, 2000). Chapman, Mahlk, 2004, concur that computers and Internet supports constructivist learning by providing worldwide available resources and information that helps teachers and students to access information and construct meaning out of that information and this makes learners more independent, they do not wait to be fed by the teacher but can explore the learning material on their own. (Chapman & Mahlk, 2004).

#### 2.1.6.3 Administration

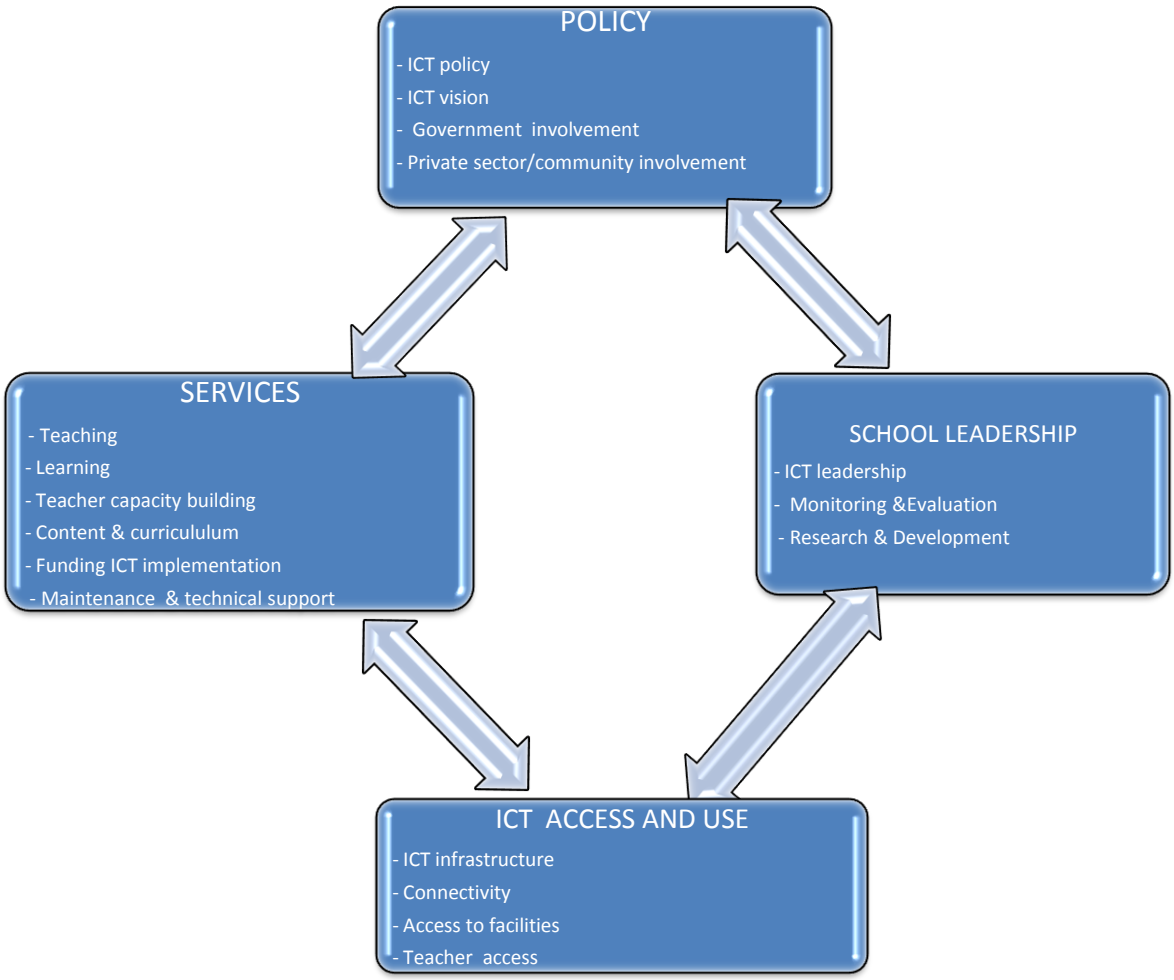
From the interviews conducted by the South African Institute for Distance Education (SAIDE) in schools in South Africa, both teachers and learners indicated that they have benefited from use of ICTs. They argued that computers save their time, fasten their work and make their work more presentable. (Bialobrzeska & Cohen, 2003). ICTs also makes school administration more effective by providing better tools for data sharing and transfer, teachers can make their lesson plans, they can track students performance and the capability of computers to provide automated assessments and reporting makes teachers and administrators work more easy to administer and plan with confidence (Chapman & Mahlk, 2004).

### 2.2 Conceptual Framework for ICT implementation in Schools

As discussed in literature review, the factors considered in this framework for the implementation of ICT in schools should be taken into consideration, some of these factors considered have been also considered in other frameworks for ICT implementation in schools (Baylor & Ritchie 2002; Kozma & Anderson, 2002; Calabrese, 2002; Anderson & Dexter, 2005; Pelgrum, 2001).

For effective implementation and integration of ICTs into education system, there is a need for a blend of adequate enabling policy, practical and operational measures. The figure below (2.1) summarises these policy and practices required for effective implementation and integration of ICT in education.

**Figure 2. 1: A Conceptual Framework for ICT Implementation in schools**




The literature review showed factors that favour or hinder the implementation and integration of ICT in schools, some of these factors are summarized in the conceptual framework (Fig 2.1).

There is a need for a clear and comprehensive national ICT policy environment that supports the implementation and integration of ICTs in education, which is enabled by national authorities and involve all stakeholders, including public, private and community.

Education institutions/schools both public and private should be supported in terms of provision of ICT facilities, government funding should be availed dedicated to procuring appropriate hardware and software, acquiring teaching and learning tools, carry out the professional development of teachers, install and pay for Internet connectivity, upgrading, maintenance and replacement of hardware and software.

Access to ICT facilities and resources by both teachers and students to support what they teach/learn should be well planned and a national monitoring and evaluation mechanism should be in place at the national level that makes it possible for policy makers to perform monitoring and evaluation of the strengths and weaknesses of the policy implementation.

Computers should be deployed with appropriate content and software applications to meet the needs of students. Curriculum should match the requirements, needs and priorities of education. Computers should have basic software like word processors and spread sheets, administration software tools like accounting and education management software and electronic content like e-books.

Training and professional development of teachers is critical, for effective implementation and integration of ICT in schools; a critical mass of teacher training programmes should be in place both in teaching ICT as a subject and in using ICTs to teacher other subjects and in order to guarantee efficient and effective implementation and integration of ICTs in schools, technical support should be an integral part of schools overall school plan, in school technical support is essential for ICT feasibility in any given school.

# CHAPTER THREE

# CASE STUDY FOR NEPAD E-SCHOOLS REVIEW

## Introduction

This chapter describes the research methodology that guided this study. The chapter begins with a justification for the research paradigm chosen and then proceeds with a discussion of the research design approach, a case study approach and reasons why a case study was selected is discussed. This is followed by a presentation of different procedures used in selecting participants, the sampling and the data collection methods and instruments for data collection that were applied in this research are then mentioned and explored. Although the research sample is small, the researcher attempts to provide a brief explanation about the sampling and participants, and then discuss the reason why they were chosen. This is followed by a description of data analysis method. The chapter will then conclude with a brief description of the ethical issues, reliability, validity and triangulation of data and limitations of the methodological approach that informs this research.

Gelo, Braakmann, and Gerhard (2008) argue that methodology deals with the logic of research methods, and refers to principles governing the research activity. It can be defined as a set of rules, principles and formal conditions which ground and guide scientific inquiry in order to organize and increase our knowledge about phenomena. Silverman (2006) states that the way a researcher argues the suitability and utility of his or her choice of methods is his/her methodological reasoning. Methodology is therefore more than a collection of methods but also indicates what their value in a study is and why they have been chosen (Silverman, 2006). Silverman also distinguishes the terms methodology and method, he refers to methodology as the coherent group of methods that complement one another and have the goodness of fit to deliver data and findings that will reflect the research question and suit the research purpose and the term method denotes a way of doing something and the methods of data collection and analysis will also be coherent because the researcher thinks about them in a way that makes sure that they are compatible with the study. The researcher is the methodologist-in-action; therefore she/he clearly indicates where she/he stands in terms of methods and methodology (Silverman, 2006).

### 3.1 Context of the study

The study was conducted in three NEPAD e-schools located in different parts of the country, school A is a rural school in Southern Province in Nyanza District, school B is also a semi-rural school in western province in Rubavu District and school C is urban school located in Kigali city in Nyarugenge District. Below is a map of Rwanda showing the location of six NEPAD e-schools of which three are case study schools.

**Figure 3. 1: Map showing location of NEPAD e-schools in Rwanda**




***Source***: Gatare, 2005

### 3.2 Problem statement

The use of ICTs extends into all aspects of both society and our lives. Governments and institutions around the world have recognised the critical importance of education for improving life of citizens and economic development and national education polices have put education as central to achieve national ICT objectives (Bransford, Brown & Cocking, 2000; Kozma & Anderson, 2002; Trucano, 2005). Rwanda acknowledges the importance of ICTs in education and therefore Rwanda attempted to follow global trends and developed national ICT policy and an ICT in education policy. ICT has been emphasised in most of Rwanda's different sector policy pronouncements like Vision 2020, Rwanda ICT Policy, Rwanda Education Sector Policy, National Science, Technology and Innovation Policy, EDPRS, ICT in Education Policy.

The NEPAD e-schools programme has made efforts in terms of providing access to ICT facilities in Rwandan schools. The issue of putting policy into practice then arises as to how Rwanda ICT in education policy and NEPAD e-schools policy are being put into practice in schools for effective ICT integration into teaching, learning and effective management of schools. It was found in the literature that, having policies that emphasise the use of ICT in education and having access to ICT facilities does not imply usage and (any) usage does not mean effective usage is happening. "The experience of introducing different ICTs in the classroom and other educational settings all over the world over the past several decades suggests that the full realisation of the potential educational benefits of ICTs is not automatic" (Tinio, 2003:3). Tinio further argues that effective integration of ICT is process that not only involves the acquisition of technology, but many other things need to be in place among which are, existence of curriculum, ICT competent teachers, school readiness, presence of long term financing mechanisms (Tinio, 2003).

The problem being investigated in this case study is to consider effectiveness of ICT in schools in order to inform policy and strategies to overcome barriers found in this present study and those barriers discussed in the literature review.

In Rwanda, no study has been undertaken aimed at investigating how ICTs have been used in teaching, learning and effective school management since the introduction of NEPAD e-schools programme. There is also no study that has been conducted to investigate what schools are using ICTs for in accordance with the requirements of ICT policy and NEPAD e-

schools policy. Lack of such information on the use of ICTs in NEPAD e-schools therefore led to the present study.

### 3.3 Purpose statement

ICTs have been a great enabler in all economies of the world in the past two decades and institutions, firms and society across the world have increasingly relied on them. In emphasising the importance of ICTs, Castells noted that: "Information technology, and the ability to use it and adapt it, is the critical factor in generating and accessing wealth, power, and knowledge in our time" (Castells, 1998: 93). However, it is well known that there exist a digital divide between industrialised and developing countries in terms of their access to and ICT usage. It is, therefore, critical to find ways of bridging this digital divide, in order for developing countries like Rwanda and other African countries alike are not left behind in the digital age. School administrators and teachers in schools are expected to play an important role in the sustained implementation of ICT in schools and also make sure that teachers and students are exposed to the effective use of ICT in their teaching and learning practices.

The purpose of this research, therefore, is to investigate how the Rwanda NEPAD e-schools project is achieving its objectives, purpose and outcomes. This study will investigate successes and barriers to the effective utilisation and integration of ICTs in Rwanda's NEPAD e-schools, issues like existence of ICT policies, ICT vision and ICT leadership in schools, teaching and learning practices, access and utilisation of ICT facilities, teacher training and professional development, curriculum development and content alignment, maintenance and technical support and monitoring and evaluation for improvement and then provide lessons for Rwanda ICT in education policy.

### 3.4 Research Questions

The main research question for this study is: How are the lessons from the NEPAD e-schools project useful for the Rwanda ICT in education policy and the national ICT policy?

To address the above question, sub-questions are posed to give extra insight to the research main question

1. To what extent are the available ICT resources in NEPAD e-schools being utilised to improve teaching and learning practices?

2. What effect, if any, has the introduction of ICT had on teaching and learning in NEPAD e-schools in Rwanda?
3. Which factors facilitated the use of ICT in Rwanda NEPAD e-schools?
4. What are the barriers to ICT integration in the NEPAD e-schools in Rwanda?

### 3.5 Research paradigms

To make sense of research information and transforming it into data, researchers draw upon a set of beliefs or epistemological assumptions called paradigms (Foucault, 1972) or traditions (MacIntyre, 1988) related to how research evidence might be understood, patterned, reasoned and compiled. Bassey (1999) explain that a paradigm is a network of coherent ideas about the nature of the world and the function of researchers which are adhered to by a group of researchers and conditions the patterns of their thinking that underpins their research actions.

Scott and Morrison (2006), explain that methodology is also critical as ontology and epistemology affect the methodologies that underpin researchers' work. These authors define methodology, to connect it to epistemology and ontology, as the theory of how researchers gain knowledge in research contexts and why. This 'why' question is critical since it is through methodological understanding that researchers and readers of research are provided with rationale to explain the reasons for using specific strategies and methods in order to construct, collect, and develop particular kinds of knowledge about educational phenomenon.

Guba and Lincoln (1994) understand a research paradigm as the basic belief system or worldview that guides the researcher/ investigator, not only in choices of method but in ontologically and epistemologically fundamental ways. The ontology chosen to underpin this research is based on interpretive paradigm.

#### 3.5.1 Interpretive

Gall, Borg & Gall (1996) define interpretive, which shares some features with qualitative research, as grounded in the assumption that features of the social environment are constructed as interpretations by individuals and that these interpretations tend to be transitory and situational. Interpretive researchers develop knowledge by collecting primarily verbal data through the intensive study of cases and then subjecting these data to analytic induction.

The interpretive paradigm was used to guide this qualitative research. This research comprises three NEPAD e-schools as case study. The variables to explore were, mainly, the perceptions and views of Ministry of Education staff, school principals, ICT coordinators, teachers and students of 3 case study NEPAD e-schools. Their views were grouped under themes such as extent of ICT use in NEPAD e-schools, improvements in teaching learning and practices in NEPAD e-schools, barriers to the integration of ICTs in NEPAD e-schools and strategies for the future implementation of ICT in NEPAD e-schools.

Analysing these themes involved interpretive that has been summarised by scholars (Crotty 1998 and Neuman 2000), as relating to the assumptions that individuals use when seeking to understand the world in which they live and work. Individuals develop subjective meanings of their experiences which they direct towards certain objects or things. These meanings are varied and multiple, leading the researcher to look for the complexity of views rather than narrowing meanings into a few categories or ideas. The goal of the researcher in this case study was to rely as much as possible on the participants' views of the situation being studied. The researcher's questions were broad and general, through semi-structured interviews, so that the participants could construct their own meanings of the situation (Creswell, 2009).

Crotty (1998) argues that the interpretive philosophical assumption is that the basic generation of meaning is always social, arising in and out of interaction with human community. The process of qualitative research is largely inductive with the inquirer generating meaning from the data collected in the field.

Neuman (2003) understands the interpretive philosophical assumption in social science research as concerned with how people interact and get along with each other. This interaction was a key factor to comprehend the respondents' experience and their participation in how they viewed the use of ICT in case study NEPAD e-schools.

### 3.6 Research Design

According to Gelo, Braakman and Gerhard (2008), a research design is a structure that links the foundations of philosophy and methodological assumptions of an approach to the research method to give credible and legitimate answers to research questions. Research design is also important in that it guides the decisions that a researcher must take during a research study and provides logic that guides the researcher to make interpretations at the end of the

research. According to McMillan and Schumacher (2006), a research method describes how the study is going to be conducted and summarizes procedures to follow. This study will be based on the interpretive case study, qualitative approach.

### 3.6.1 Qualitative case study research

McMillan and Schumacher (2006), defines qualitative research as an inquiry in which researchers collect data in face-to-face situation by interacting with selected persons in their natural setting. According to (Vulliamy, 1990) qualitative research involves participant observation and in-depth interviewing. Vulliamy also indicates that in education research, the qualitative research method is useful when focusing on teachers and principals and on classroom and school interaction (Vulliamy, 1990). In this study, the researcher conducted face-face interviews with school principals, teachers and students.

According to Babbie (2004), a qualitative research "involves the non-numerical examination and interpretation of observations, for the purpose of discovering underlying meanings and patterns of relationship" (Babbie, 2004:370).To further describe what a qualitative research is, Creswell describes the intent of a qualitative research paradigm as understanding a social situation through an investigative process where "the researcher gradually makes sense of a social phenomenon by investigating the object of the study" (Creswell, 2003:198).In this instance the social situation under investigation is the use of ICT in Rwanda NEPAD e-schools and how the use of ICT in schools contribute to the overall school and students improvement in management and learning process respectively. Creswell further argues that the investigation of a social situation can be achieved by comparing, contrasting, cataloguing, replicating and classifying the object under investigation (Creswell, 2003).

Qualitative research has different approaches of inquiry such as phenomenological, biography, grounded theory, ethnography and a case study. The assessment of a programme like NEPAD e-schools programme will adopt a case study approach as it aims to assess how existing project case is managed and implemented. The case study approach is appropriate in qualitative research because it has a focus on a natural setting; an interest in meanings, perspectives and understandings; and an emphasis on process (Woods, 2006; Creswell, 2003).

Yin (1989), explains a case as an event, a unit of analysis, an entity or even an individual, Yin further explains that a case is an empirical inquiry that looks at existing phenomenon within

its real life context using multiple sources of evidence (Yin, 1989). Case studies according to Anderson are concerned with how things happen and why they happen, case studies allow investigation of similarities and differences of what was initially planned and what actually happened, case studies focus on a particular issue, an entity, feature or an individual, it is not intended to study the entire organisation ( Anderson, 1993).

Bassey (2007) defines an educational case study as an empirical enquiry which is conducted within a localised boundary of space and time. Case study relates to any aspect of an educational activity, programme, or institution, or system, mainly in its natural context and within an ethic of respect for persons in order to inform the decisions of practitioners or policy-makers, such that sufficient data are collected for the researcher to be able:

> to explore significant features of the case, create plausible interpretations of what is found, test for the trustworthiness of these interpretations, construct a worthwhile argument or story, relate the argument or story to any relevant research in the literature, convey convincingly to an audience this argument or story, provide an audit trail by which other researchers may validate or challenge the findings, or construct alternative arguments (Bassey, 2007: 143).

Johnson (1994) mentions several possible disadvantages of case study that should be considered during the design phase. First, it may lack scientific rigour in that the design of the case study is situation-dependent and follows no set rules. It is therefore heavily dependent on the skills of the researcher. Secondly, the material may be unique, that is not generalisable so that the findings about a specific case may not be meaningfully transferred to another situation at another time. Thirdly, there may be possible uneven access to all aspects of the phenomenon to study. In the fourth instance, the case study relies on time, ready access to settings and familiarity with a range of research skills (Johnson, 1994). This research design intends to address these disadvantages, the study made sure that it followed the rules of research and the result can inform other schools in similar situation.

Gummesson (1991), however provides strengths of case study, he points out that case study enables the researcher to have a holistic view of an event or a series of events and can provide an overview of a certain phenomenon or series of events under investigation since multiple sources of evidence were used (Gummesson, 1991).

Three NEPAD e-schools were selected as case studies for this research. The researcher conducted these case studies because little is known about the use of ICT in NEPAD e-

schools in Rwanda, before conducting this present study, the researcher could not find any other research that was done on the use of ICT in NEPAD e-schools in Rwanda. Leedy and Ormrod (2005:135) argue in researchers favour that "a case study is suitable for learning more about a poorly understood or little known situation". The use of ICT in NEPAD e-schools in case of Rwanda is a new phenomenon that needs to be studied because little is known about it.

### 3.7 Sample selection

#### 3.7.1 Sampling methods

In a study of any nature, Salant and Dillman (1994) argue that sampling is a key step because it assists the researcher to establish the quality of conclusions she/he makes from the research findings. De Vaus (2002), defined sampling as a procedure of selecting few individuals from a large population in such a way that the selected individuals represent a large part of population from which they were selected. According to Patton (2002) sampling is process of selecting what to study and focusing on a part of population. Parasuraman, Grewal and Krishnan (2004) agree with De Vaus and Patton that sampling is the selecting of a fraction of the population for the purpose of being able to draw broad deductions about the entire population.

In qualitative research, Patton (2002) argue that selection of a sample tends to be purposive rather that random. Purposive sampling according to Parasuraman et al. (2004) is a procedure in which a researcher selects a sample that she/he considers most suitable for the study and is more representative of the population rather than considering to select a sample that is convenience (Parasuraman et al., 2004).

The purposeful sampling strategies have guided the selection of the site and the informants for this study. Purposeful sampling is about selecting the information-rich cases for studying in-depth the issue being researched (McMillan & Schumacher, 2006). As suggested by McMillan and Schumacher, this sample is chosen in qualitative research because it is likely to yield important information about the phenomenon investigated.

#### 3.7.2 Sample size

In the present study three schools were purposefully selected to represent the six NEPAD e-schools. The three schools were selected nationally because they met criteria set by NEPAD e-Africa Commission. The most important criteria used to select the case study schools was based on the location of schools (both urban semi-rural and rural) to give a balance between the existing categories of Rwandan schools. The three selected schools were; one urban school, one semi-rural and one rural. Before the researcher selected the three schools he first called school principals on phone, those that were willing to collaborate were selected and lastly, the researcher had a limitation of transportation and financial constraints, therefore schools were also chosen depending on easy access to transport facilities.

### 3.7.3 Participants

The number of participants in this research was thirty one in total: One Rwanda Country Liaison Person for the NEPAD e-schools, three Principals, three ICT coordinators, six teachers and eighteen students. Teachers were selected by the principal of the school on criteria that they must have had training; they must have access to computers and should be innovative and confident in use of ICTs. Students were also selected by the principal on criteria that they have access to the ICT facilities and are representative of gender and school grade levels.

**Table 3.1: Table showing total number of respondents of the study**

| Categories | Number of respondents |
|---|---|
| CPL for NEAD e-schools | 1 |
| School principals | 3 |
| ICT coordinators | 3 |
| Teachers | 6 |
| Students | 18 |
| **Total** | **31** |

McMillan and Schumacher (2006), suggest that the logic of selecting the sample size is related to the research purpose, the problem under investigation, the data collection strategy, and the availability of information-rich cases. The insights generated from qualitative research depend more on the information rich cases, and the capabilities of the researcher to make analysis than on the sample size. McMillan and Schumacher further state that, qualitative researches are guided by circumstances, that is, a study may have a small sample size, but the researcher may be continually seeking confirmation while returning to the same situation or informants in his research (McMillan and Schumacher, 2006).

In selecting individuals or sites for the research study, Creswell (2003) suggest that purposefully selected sites or individuals would help the researcher understand the research purpose, research problem and research question, therefore in this case the interviewed sample does not represent the whole population, the sample only represents a small sample of the population (Creswell, 2003). The sample population in this research was purposefully

selected as they were thought to be information rich to be able to contribute to answer the research questions and they are stakeholders of the Rwanda NEPAD e-schools initiative

**Table 3.2: List of stakeholders**

| No. | Interview Date | Stakeholder and Acronym |
|---|---|---|
| 1 | 18/03/2011 | Country Liaison Person (CLP) |
| 2 | 21/03/2011 | School Principal 1 (SP1) |
| 3 | 23/03/2011 | School Principal 2 (SP2) |
| 4 | 25/03/2011 | School Principal 3 (SP3) |
| 5 | 21/03/2011 | ICT coordinator 1 (ICTcA) |
| 6 | 23/03/2011 | ICT coordinator 2 (ICTcB) |
| 7 | 25/03/2011 | ICT coordinator 3(ICTcC) |
| 8 | 22/03/2011 | Teacher A1 (TA1) |
| 9 | 22/03/2011 | Teacher A2 (TA2) |
| 10 | 22/03/2011 | Teacher B1 (TB1) |
| 11 | 22/03/2011 | Teacher B2 (TB2) |
| 12 | 28/03/2011 | Teacher C1 (TC1) |
| 13 | 28/03/2011 | Teacher C2 (TC2) |
| 14 | 22/03/2011 | Student A1 (SA1) |
| 15 | 22/03/2011 | Student A2 (SA2) |
| 16 | 22/03/2011 | Student A3 (SA3) |
| 17 | 22/03/2011 | Student A4 (SA4) |
| 18 | 22/03/2011 | Student A5 (SA5) |
| 19 | 22/03/2011 | Student A6 (SA6) |
| 20 | 24/03/2011 | Student B1 (SB1) |
| 21 | 24/03/2011 | Student B2 (SB2) |
| 22 | 24/03/2011 | Student B3 (SB3) |
| 23 | 24/03/2011 | Student B4 (SB4) |
| 24 | 24/03/2011 | Student B5 (SB5) |
| 25 | 24/03/2011 | Student B6 (SB6) |
| 26 | 28/03/2011 | Student C1 (SC1) |
| 27 | 28/03/2011 | Student C2 (SC1) |
| 28 | 28/03/2011 | Student C3 (SC1) |
| 29 | 28/03/2011 | Student C4 (SC1) |
| 30 | 28/03/2011 | Student C5 (SC1) |
| 31 | 28/03/2011 | Student C6 (SC1) |

This case study research attempted to obtain information about ICT use in three NEPAD e schools in Rwanda and the view of Ministry of Education on ICT implementation in schools, the sampling method used in this research is purposeful sampling method (Kumar, 1996). According to Kumar, within purposeful sampling method, the researcher is selective "as to who can provide the best information to achieve the objectives of the study" (Kumar, 1996:162).

### 3.8 Data collection instruments

In this study, the data collection will consist of three common methods used in qualitative research, in-depth interviews, focus groups and document analysis.

#### 3.8.1 In-depth individual interviews

This study used Semi-structured interview, these interviews were conducted with the Country Liaison Person for the NEPAD e-schools; School Principals; ICT coordinators, teachers and students (Appendix A). The major advantage of interview is its adaptability; the interviewer who is skilful can follow up ideas, probe responses and study motives and feelings that a questionnaire cannot do. Mack, Woodsong, M.MacQueen, Guest, Namey (2005) argue that an interview allow the gathering of data on individuals' personal perspectives and views as well as allows probing. This method is useful for the researcher because it helps to learn about the perspectives of individuals. Since in-depth interviews were conducted on an individual basis, people expressed their personal feelings, opinions and expectations (Mack et.al 2005). Gall, Borg and Gall (1996), describe semi-structured interviews as a data collection procedure where the interviewer just reads the pre-defined questions and records the answers related to one or more issues related to research questions.

#### 3.8.2 Focus groups

The researcher interviewed six students per school in three case study schools in the same focus group. Kitzinger (1995:299) described focus group as: "a form of group interview that capitalizes on communication between research participants in order to generate data". Gibbs (1997) lists advantages of focus groups as encouraging participation from respondents who would be reluctant to be interviewed on their own.

The researcher chose to use a focus group method in this case study because it represents a sound method of enquiry with much potential for the study of students using ICT. All students who participated in the research were interviewed in the focus group. Krueger (1998) describe focus groups as important technique because they offer a way for researchers to listen to voices of many and make audible the voices of people who want to be heard. The research followed the following process: The researcher prepared interview schedule, conducted an interview and the focus group participants gave their responses. The researcher started his structured interview guide with some opening general question, asking students' opinion about what they considered importance of ICT in schools and significance of being

computer literate. After asking the general question then the researcher started asking more specific interview questions about the importance of using ICT in schools. The general question made participants move away from the topic, telling the researcher more of the things he had not earlier considered in his interview questions.

### 3.8.3 Documentary Analysis

The researcher carried out policy analysis for Rwanda ICT policy, Rwanda ICT in education policy, NEPAD e-schools documents and other ICT in education related documents. The analysis of these policy documents complemented data from in-depth interviews and focus groups interviews. Keats (1982) defines documentary analysis as "a technique which relies heavily upon a variety of written materials for data, insights and judgments about programme or events" (Keats, 1982:2). He further asserts that, although document analysis can stand on its own for gathering data, ideally it is used in conjunction with other research techniques like in-depth interviews (Keats, 1982).

For documentary analysis, the researcher focused on content analysis using available documents. Robson (1994) regards reliability as one of the advantages of content analysis because data are in permanent form and hence can be subjected to re-analysis, and allowing reliability checks and replication of the study.

## 3.9 Ethical considerations

Ethics in research include "policies regarding informed consent, deception, confidentiality, anonymity, privacy and caring". McMillan & Schumacher (2006: 333). Ethics is concerned with ensuring that the interests and wellbeing of participants are not violated as a result of the research. To maintain that ethical issues are not violated, the researcher applied clearance from the university to conduct research (Appendix B), the researcher got permission from Ministry of Education to access schools (Appendix C and D), the researcher also got permission from research site (Appendix E, F and G). The researcher ensured participants that they will not be exposed in anyway; participants were also informed that they have the right not to participate in the research if they feel uncomfortable. (Appendix H). Cohen, Manion and Morrison, state that ethics embody individual and communal codes of conduct based upon adherence to a set of principles which may be explicit and codified, and which may be abstract and impersonal or concrete and personal (Cohen, Manion & Morrison, 2000)

### 3.10 Data Analysis

Audrey (1989) argues that the process of collecting data is itself not enough, unless the data collected is analysed and translated into a manner that is important, reasonable and understandable to the users of the information. According to De Vos, Strydom, Fouche and Delport (2002), data analysis is a process of bringing order to data collected, giving structure logic and sense to the data collected. They further state that the rationale of the process of ordering and arranging data is to reduce data to a logical, clear and interpretable structure so that the research problems can be studied, analysed and allows for conclusions to be drawn.

McMillan& Schumacher (2006) refers to qualitative data analysis as a process of coding, categorizing and interpreting data to provide explanation of a single event of interest. Creswell (2002) suggests that, in qualitative research, the researcher analyses and converts huge amount of information collected into meaningful patterns or themes, after categorising the information the researcher them makes the interpretation.

After interviews were conducted, the field notes had to be entered into a computer. The researcher transcribed all interviews word for word from field notes into a computer. According to Miles and Huberman (1994), the process of interview transcription is very crucial because it makes the researcher familiarise with the data, by reading the interview transcriptions and field notes repeatedly, the researcher got familiar with the content. The second step the researcher took to analyse data was to categorise and sort data into coded sets and breaking codes into sub categories and putting them under themes.

Bogdan and Biklen (1992), suggest that in data analysis, what happens is that data is sorted into coded sets, then identify sub-sets and then put data into various topics. The main codes give broad categories and the "sub-codes break the major codes into smaller categories" (Bogdan and Biklen, 1992:177).

### 3.11 Reliability Triangulation and Validity

#### 3.11.1 Validity

The validity of the qualitative research design is the degree of congruence between the explanations or interpretations of the phenomenon and the reality of the world and the mutual meanings between the researcher and the participants (McMillan & Schumacher, 2006). Validity addresses the question whether the researcher captures what she/he thinks is valid

(McMillan & Schumacher, 2006). McMillan and Schumacher further argue that validity is a judgment of the suitability of a measure for specific inferences or decisions that result from the score generated. They add that accessing validity depends on population you want to study, the purpose of the study and environmental characteristics in which measurement takes place. To guarantee validity, the researcher needs to identify assumptions or make arguments to justify an inference or use for a specific purpose and then collect evidence to support these assumptions.

To be secure whether the data collected contains information that the researcher thinks they contain, 'participant review' as one among strategies was used to enhance validity (McMillan & Schumacher, 2006).

To ensure validity of the study, the researcher used a multi-sources, multi-tools and multi-sites strategy that allowed triangulation of data collected and data analysis. The study was qualitative research case study and used a multi-tools of data collection, semi-structured interviews with school principals, ICT coordinators, teachers in three case study NEPAD e-schools and a staff from Ministry of Education, document analysis and focus group interviews with students of the three schools. McMillan and Schumacher (2006) comment that most qualitative researchers employ several data collection techniques to enhance validity but usually select one as a central method. Interviews and documents analysis are techniques that were used together. These different data collection techniques gave different insights about the author's research topic and increased the credibility of findings.

### 3.11.2 Reliability

Scott and Morrison (2006) explain that a measure is reliable if it provides the same results on two or more occasions, then the assumption is made that the object being measured has not changed. When a series of measures give similar results, it is possible to say that it has high reliability. Another way to conceptualise reliability is to determine the extent to which measures are free from error (McMillan & Schumacher, 2006).

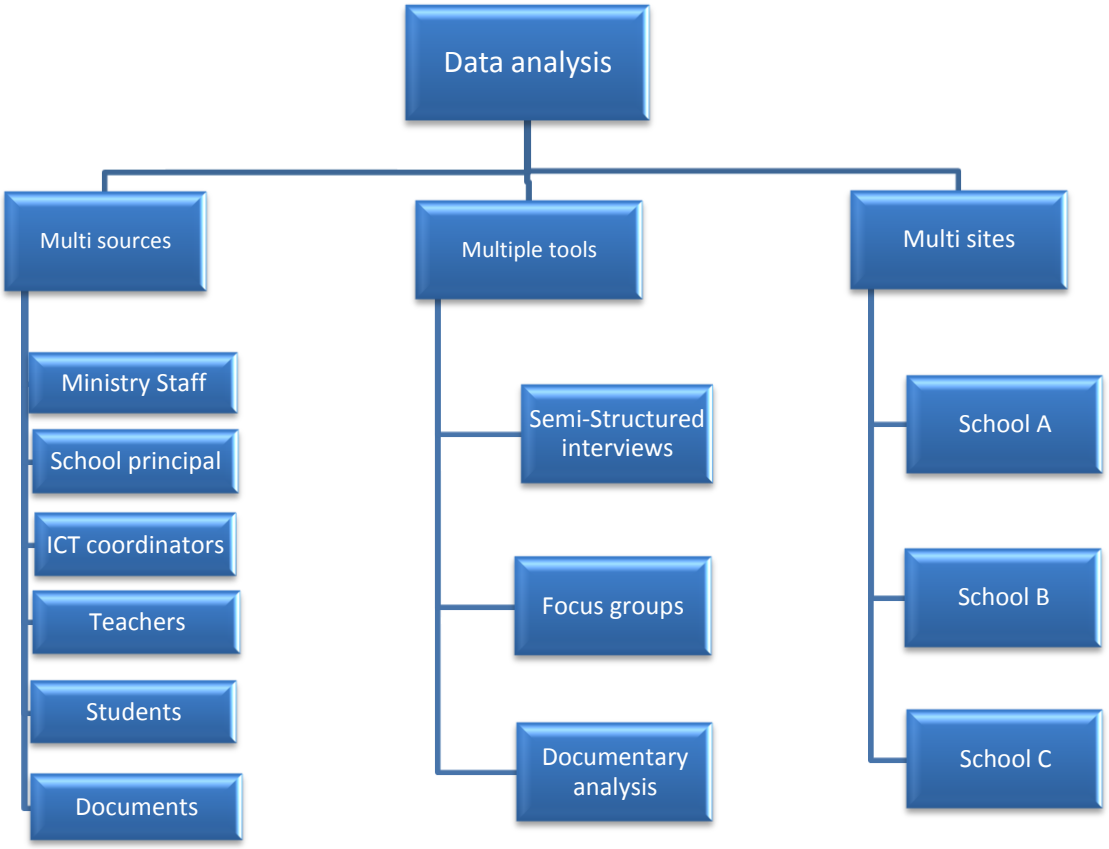
In qualitative research, Yin claims that, the skills of the researcher heavily determines the success of the research project, since the researcher is the primary instrument, therefore, lack of researchers' experience can have potential effect on the reliability of the findings (Yin, 2003). To address this risk, the researcher used multiple tools for data collection, multiple sources of data, and multiple case studies. Comparing data from different sources, interacting

with participants directly using same interview protocol, conformity of interview guides to the research problem and consulting with the researcher's supervisor constitute some of the strategies the researcher used to enhance reliability.

### 3.11.3 Triangulation

In order to overcome the threat of bias and enhance trustworthiness and credibility of the findings, there is a need to use several methods of data collection. In this present study, data obtained from interviews, documentary analysis and focus group interviews were triangulated during data analysis. In triangulation, the researcher used multiple tools for data collection, multiple sources of data, and multiple case studies (fig. 3.2). Data were triangulated in the following manner: Data from interviews from different sources were compared; data from school principals were compared, with Ministry of Education official, with ICT coordinators and vice versa. Data from focus group interviews and policy analysis were also compared with data from interviews with Ministry official, principals and teachers. The aim of triangulation of data from multiple tools of data collection, to multi sources and multiple sites was to enrich and strengthen the researchers understanding of the issues without bias. To emphasise the use of multi-methods to ensure that there is no bias, Cohen, Manion and Morrison (2000), define triangulation as the use multi- methods of data collection in the study of some aspect of human behaviour.

**Fig 3.2 Triangulation strategies**




## Conclusion

This chapter described the research methodology that guided this study. The chapter justified the research paradigm chosen and then preceded with a discussion of the research approach, a case study approach was adopted and a reason why a case study was selected was discussed. Different procedures used for sampling and the data collection methods and instruments were discussed and explored. This was followed by a description of data analysis. The chapter concludes with a brief description of the ethical issues, reliability, validity and triangulation of data.

# CHAPTER FOUR

# CASE STUDY FINDINGS FROM NEPAD E-SCHOOLS

## Introduction

The purpose of this research was to investigate how the Rwanda NEPAD e-schools project is achieving its objectives, purpose and outcomes. This will enable an analysis of successes and barriers to the effective utilisation and integration of ICTs in Rwanda's NEPAD e-schools and investigate successes and barriers of e-schools and lessons for Rwanda ICT in education policy.

This chapter presents the findings of the study on Policy insights from an assessment of three NEPAD e-schools in Rwanda. Apart from the literature review in chapter two that provided fundamental theories of the importance of computers in schools and implementation of ICT in schools in general, other methods of data collection were also used. Evidence was sought from Country Liaison Person (CLP) for NEPAD e-schools at the Ministry of Education, School principals of the three NEPAD e-schools, ICT coordinators of those three schools, teachers and students through semi-structured interviews, focus group interviews and documentary analysis as means of data collection. The interviews were conducted to gather evidence from school officials on their experiences in the use of ICT in their respective schools and from Ministry of Education official to get an overview of policy issues around the implementation and integration of ICT in schools in Rwanda.

The presentation of qualitative data in this chapter is organised according to the themes flowing from the research sub-questions for this study. The themes are: extent of ICTs in NEPAD e-schools, improvement in teaching and learning practices in NEPAD e-schools, barriers to the integration of ICTs in NEPAD e-schools and strategies for the future implementation of ICT in NEPAD e-schools.

## 4.1 School A

The school was founded and is still run by catholic Fathers but aided by the government. The school is a rural school situated in Nyanza District in Southern Province. The administration of the school includes School principal, study monitor, discipline monitor, the bursar and secretary. The school has 20 teachers and 12 workers. It has 440 boys and 100 girls, who are all boarding students. Their ages range between 12-18 years. The school is one of the six

schools in Rwanda that benefited from the NEPAD e-schools project and the installation of the equipment at school was done by Microsoft on behalf of NEPAD. The school has 20 networked computers from NEPAD but has no Internet connection currently. Before NEPAD e-schools project, the school had purchased five used computers but they are old and no longer functioning. The total number of respondents in school A was ten; one school principal, two teachers and six students interviewed in focus group. The table below shows the number of ICT equipment that exists at school both from NEPAD e-schools project and other sources.

**Table 4.1: ICT equipment at the school both from NEPAD and other sources**

| Equipment at the start of the project | No. of NEPAD equipment | Equipment from other sources | Available and functional at the time of visit |
|---|---|---|---|
| Desktop computers | 20 | 5 | 16 |
| Server | 1 | | 1 |
| Laptops | | | |
| Printer | 1 | 1 | 2 |
| Scanner | 1 | | 1 |
| Photocopier | 1 | 1 | 1 |
| Projectors | 1 | | Not functional |
| white board | 1 | | Not functional |
| Satellite TV | 1 | | 1 |
| Satellite dish | 1 | | 1 |
| UPS | 1 | | 1 |
| Internet | Installed | Not working | |
| Learning content | Installed | Not available | |

### 4.1.1 Extent of ICT utilization in NEPAD e-schools

This section relates to the findings of research sub question one which seeks to find out the extent of the utilization of ICTs in NEPAD e-schools and research sub question three which looks at factors that facilitate the use of ICTs in NEPAD e-schools**.**

#### 4.1.1.1 ICT Vision, Policy and Leadership

The principal of school A was asked if the school has an ICT vision and policy. The principal said the school has a policy, when asked if I could look at the copy of the policy, the principal said that it is not a written policy as such, it is like an ICT vision that "All teachers and students of the school should be ICT literate in order to achieve the country's vision 2020". (SPA March, 2011).

The principal reported that there is a committee responsible for ICT in the school. The representatives on the committee are School principal, Director of studies, two teachers in charge of ICT, two students, a boy and a girl. On the question whether the school was adequately prepared to take on the responsibilities associated with introducing ICT in schools for more effective teaching and learning, the principal said the school was not prepared.

> we had no ICT equipments before, we had only two computers and a printer used by secretary to type and print examinations, most of our teachers had no ICT skills, there was no training on computer skills before, a five day training was conducted by NEPAD after the installation of ICT facilities and this training was not for all teachers, it was only for two teachers and school principal. Five days training did not give teachers much confidence to be able to teach comfortably using ICT (SPA March, 2011).

Both teachers interviewed in school A confirmed that there were no clear roles and responsibilities given to schools in terms of the NEPAD e-schools programme.TA1 said that:

> No clear roles, the NEPAD e-schools programme conducted training to some teachers at school but neither NEPAD nor the school principal gave clear roles and responsibilities on what teachers should do with the lab, the lab is used only to teach ICT lesson and that is the curriculum that is available from Ministry of education (TA1 March, 2011.)

#### 4.1.1.2 Access to ICTs

Data from interviews and documents consulted suggest that teachers and students have access to ICT facilities, but access is restricted as was revealed by respondent ICTcA who coordinates the computer lab and who is at the same time ICT lesson teacher. Teachers can have access whenever they have time but without disrupting the lessons, students are restricted to only ICT lesson timetable.

All classes have access two hours per week. This is time put by Ministry of Education in ICT curriculum, but students who are in student clubs ( news club, science club) also have time to use the lab on request and after school hours (ICTc1 March, 2011). TA2 said that, teachers generally have access to the computer lab whenever they are free but the problem is lack of time, teacher access to computer lab depends on time he has during the day.

> We are free to use computer lab but the problem is lack of time, we teach from 8h00 am – 13h00, break for lunch, resume teaching at 14h00 up to 17h00, you really do not have that much time for the computers, however the lab is open for use in the evenings from 19h00 up to 21h00 (TA2 March, 2011).

Students interview in focus groups disclosed limited access to computer lab, they revealed that they can get more resources for their studies if they have access to computer lab whenever they want, but they are restricted to access only once a week and what they do is to follow what the teacher is teaching, they said that they do not have more practice and access to computer lab, Students had different views on how they access ICTs and Internet outside the school, SA2 said that she has no other access apart from computer lab, SA1 said that in holidays he has access to a computer and Internet at home and he can search for information regarding his subject and chat with friends, SA5 reported going to cyber café often in holidays but when at school no other access apart from computer laboratory. All students commented that they used to have access to Internet during their ICT lesson and get more learning materials, but now no Internet is available in their computer lab.

#### 4.1.1.3 Use of ICT

As indicated above, both teachers and students have access to computers, interview with teachers on how they integrate computers into their lectures, lesson preparation, communication and research, both teachers interviewed indicated that teachers used computers mainly for preparing tests and exams for students and doing mark sheets but they

also mentioned that some teachers use projectors and interactive white boards to present their lessons, some teachers use Encarta software available on computers to supplement their teaching material, they however reported that the projector and interactive white board are no longer working so this has had an impact on some teachers who used them to present their lessons, lack of enough training and lack of enough time to use ICT facilities also limit their use. One teacher interviewed noted that "the issue that impedes us teachers and students from using computers is lack of time". He commented that they most of the time have no time to use computers as they are involved in many other activities at school. " I teach Biology from senior four to senior six, I have to prepare teaching materials, prepare and mark assignments, prepare and mark examinations, etc, so I find myself not having enough time for computers" (TA2 March, 2011). The use of Internet is very important for research and communication as TA1 reported

> I used Internet to get more teaching materials to add on to existing curriculum, but the school has no Internet now, there is no money to pay for monthly subscription fee for Internet as we are told by the school principal, so it is difficult for me now because I am used to the Internet, I now have to go to Internet café after school or on weekends (TA1 March, 2011).

Students interviewed in focus group had the same view on time they spend on computers, they noted that they had access only 2 hours per week studying ICT lesson and what they do is to follow what a teacher is teaching, we do not have more practice, we would like to have more time in the computer lab finding information related to our studies, but time is limited. SA5 who is a member of ICT and Geographical Information Systems (GIS) club commented that:

> School clubs for example, the school magazine club use computers to get more information and research on Internet, GIS and ICT clubs also use ICT lab. We also read and send e-mails to friends when time permits and when Internet is available. (SA5 March, 2011).

When students were asked if they used Internet for surfing websites for educational purposes, they said that they only use Internet when being taught Internet as a module, Students responded that they do not use ICT tools for any school work, its only teachers who use facilities for teaching, for us students we only have two hours per week to attend to ICT lesson and we do what a teacher instructs us to do. Computers are few and the school has no

way to make us have access any time because students have to rotate in the lab from senior one to senior six. “One student said that their teacher is willing to let them use ICT facilities but there is no time because another class will need to come in for the lesson” (SA2 March, 2011).

#### 4.1.1.4 Training and professional development

All schools reported having teachers trained in basic ICT skills, but not all the teachers were trained. The principal reported that lack of teacher ICT skills to teach with ICT is linked with ICT professional training. From the interview with the SPA, he noted that relevance and time taken for the training is very important and suggested that the situation can be improved if the training given is relevant and timely.

Teachers need to be trained on what is relevant to their teaching, they should be trained on what they need to use. The training should be scheduled well and give teachers time to familiarise before they can start applying ICT tools into teaching (SPA March, 2011). This view of time needed for the training and relevance of the training was supported by respondent TA2 who said that:

> Teachers have never had relevant and good training, the government is conducting a lot of trainings but trainings are done by technical people, sometimes they give trainings that are technical not relevant to help teachers in their teaching. To integrate ICT into teaching and learning, more relevant training should be provided (TA2 March, 2011).

The principal was asked if he had received any training in the use of computers and the value of the training received in relation to the NEPAD e-schools programme at school. The principal answered that there was no training before installation of NEPAD ICT equipments, but after installation there were a series of trainings, a five day training conducted by NEPAD, and a five day training conducted by the Ministry of Education in the use of ICT for school management. The principal commented that: These trainings were important and of great value to me particularly the training by the Ministry of Education on the use of ICT for school management. “the training made me understand my role as a principal in encouraging teachers and students to take part in ICT programmes of NEPAD e-schools as ICT facilities were provided to help them to teach and learn better with ICT”(SPA march, 2011).

The two teachers interviewed in school A were asked what special training they had received to support them in teaching, they both answered they had not received any training that support them in teaching, they said they only received ICT skills training, not specialized training to support teachers in their teaching.

#### 4.1.1.5 Maintenance and support

NEPAD provided technical support during the first year of installation of ICT equipments, however after one year; there was no support either from NEPAD or from the government in terms of technical support. On the issue of how maintenance is done, SPA revealed that:

> …regards maintenance of ICT facilities, when there is breakdown, the school hires a technician and because no budget for maintenance is available, sometimes no maintenance and equipments are kept in stores waiting when there will be funds for repair (SPA March, 2011).

The respondent ICTcA shared the view with the SPA that there is no more technical support either from NEPAD or from government. There is also no budget for hiring a technician when there is a technical problem, the school gets money from other school budget activities to repair the faulty equipment, if there is no money the equipment is left unrepaired.

### 4.1.2 Improvements in teaching, learning and administration

The question was raised on what effect ICT has had on teaching, learning and school administration at school, below are responses from different respondents.

#### 4.1.2.1 Teaching

The school principal strongly agrees that NEPAD e-school project has changed the way teaching takes place and he noted that he considers the change to be positive. The school does not have Internet now but when Internet was available, it facilitated teachers to research on the subject-based information to supplement their textbook information, the use of ICT facilities eases the teachers' work, makes lessons more presentable and saves them time. "The use of a white board and projectors facilitates and eases teachers' work because they do not need to move to every computer to help student."(SPA March, 2011).

The principal further noted that more skills have been gained that have enabled teachers present their lessons much more easily, quickly and conveniently. Teachers have used ICT facilities to access more resources from computers and Internet that can supplement/update

what they already have and what is available with other teachers/school elsewhere. ICT coordinator concurs with the principal that according to his experience as ICT coordinator he had seen both teachers and students gaining ICT skills that enabled them to use ICT facilities for teaching, learning and new innovations by students at a young age.

Two teachers interviewed (TA1 and TA2) both agreed that NEPAD e-school programme was of a great value to teachers and the whole school at large, they claim that the programme has widened their ICT knowledge, TA1 noted that: "It has widened my ICT knowledge, I had never used whiteboard before but I can now use it and it is helpful in presenting my lesson and eases my teaching."(TA1 March, 2011).

Teacher TA2 shared the same view with TA1 that teachers have gained ICT knowledge that has enabled them to teach more easily, however TA2 mentioned that though ICT has been of great value to the school, it would have made more value to all of us, administrators, teachers and students if we had more equipments for everyone to have full access and practice using ICT tools, its then that teachers can be able to take the opportunity to integrate ICT into their teaching practices and help students get more and up-to-date resources.

#### 4.1.2.2 Learning

Asked to describe how ICT has impacted their learning, students in focus group had various responses, access to information and new knowledge through Internet, their assignments can be done fast with access to Internet, SA3 and SA5 said they use ICT applications to learn and that they have helped them learn better. They also said they use Ms Word, Ms excel, Ms PowerPoint, Internet, we use also Encarta software and these applications have helped us to know how to use computers and this has helped us know how to use computers to find information on the internet.

#### 4.1.2.3 Administration

The principal said that he uses a computer to write agenda of the meetings, the secretary uses computers to type the school administrative work and minutes of the meetings the principal commented, teachers type their class exercises and examinations, they can record marks using computers, and therefore this has helped ease the administrative work.

### 4.1.3 Barriers/challenges affecting the use of ICT

From the interviews conducted with the principal of the school, he identified a number of challenges, few ICT equipments compared to the number of users, lack of effective teacher training in ICT pedagogical skills, lack of budget for maintenance of ICT facilities and Internet connectivity, lack of budget to replace the damaged and old equipments. ICTcA shared the same view with the SPA on the above challenges but strongly put much emphasis on access to ICT facilities, teacher competence and confidence in the use of ICT facilities in teaching. Both TA and TB interviewed strongly mentioned lack of relevant training, lack of enough ICT facilities, lack of time to use ICT and technical faults of the equipments as some of the challenges they face in the use of the NEPAD e-schools computer lab.

From focus group interview, students mentioned different challenges that they encounter in using NEPAD e-schools computer laboratory, some of the commonly mentioned challenges are: Computers are few, they share one computer when they are three, so some students go without having touched the computer, Students said that they do not have much time in using computers to practice what they have learnt and this makes us forget what they have learnt. Some of the equipments are not working, so the number of computers are becoming less and less.

### 4.1.4 Future development of ICT in NEPAD e-schools

For the future effective and efficient use of NEPAD e-schools all interviewees had a common view on what could be done to overcome the challenges that limit the effective use of NEPAD e-schools ICT facilities, they all mentioned that, there is a need to have more access to ICT facilities therefore there is need for more ICT equipments, the Internet issue was mentioned by every interviewee therefore for future improvement Internet access should be availed, the issue of maintenance and faulty ICT equipments was mentioned by almost all interviewees, the budget should be available for maintenance and technical support, lack of skills was also another issue that all mentioned, provision of intensive Training to teachers to be more skilled in ICT so that they can be competent and confident to teach their students is important, time and practice is important, teachers and students alike should be allowed more time to use the ICT equipments and lastly teachers are very important in the whole process, they should have full access to laptops to use even at home.

### 4.2 School B

The school is located in Rubavu District in Western Province, some 150 km from Kigali the capital city of Rwanda, the school was built in the year 2000 by the government of Rwanda. The school has a total of 696 students, 388 in lower secondary and 308 in upper secondary. The number of girls is 219 and boys are 477. The school had three options: health sciences, Biochemistry and Maths-Physics but later the health sciences option was removed and now the school has two options. The school has all laboratories for science subjects, the school has 40 computers in 2 computer labs, and one of the 2 computer labs has 20 computers from NEPAD. The school is one of the six schools in Rwanda which benefited from NEPAD e-schools initiative, and the installation of the equipment in the school was done by Microsoft on behalf of NEPAD. Computer science is compulsory from senior 1-6 and all students have basic computer literacy. The school has a challenge of their trained teachers in ICT who leave school to go and work in private schools where they earn more money than they earn in a government school. The total number of respondents in school B was ten; 1 school principal, 2 teachers and 6 students interviewed in focus group. The table below shows the number of equipments that exist at school both from NEPAD e-schools project and other sources.

**Table 4.2: ICT equipment at the School B both from NEPAD and other sources**

| Equipment at the project start | No. of NEPAD equipments | Equipment from other sources | Available and functional at the time of visit |
|---|---|---|---|
| Desktop computers | 20 | 10 | 21 |
| Server | 1 | | 1 |
| Laptops | 5 | | 3 |
| Printer | 1 | 1 | 2 |
| Scanner | 1 | | 1 |
| Photocopier | 1 | | 1 |
| Projectors | 1 | | 1 |
| white board | 1 | | 1 |
| Satellite TV | 1 | | 1 |
| Satellite dish | | | 1 |
| UPS | 1 | | 1 |
| Internet | Installed | | Not working |
| Learning content | Installed | | Uninstalled |

### 4.2.1 Extent of utilization of ICT in NEPAD e-schools

This section relates to the findings of research sub question one and research sub question three on School B**.**

#### 4.2.1.1 ICT Vision, Policy and Leadership

SPB was asked whether the school has an ICT vision and policy, he answered that there was no policy but there is a written manual on how to use the computer lab and a timetable of who has access and at what time. The principal mentioned that even if they do not have a vision and policy for ICT in school: "…the school administration encourages teachers and students to use the lab to acquire ICT skills. It also encourages teachers to use ICT facilities for lesson preparation and presentation" (SPB March, 2011)

SPB also reported that the school had some computers before NEPAD e-schools project, and therefore the school was prepared because they realised the importance of ICT but they had no capacity of acquiring more ICT facilities on their own, so he said he is prepared to take full responsibility of using ICT facilities to their full potential.

The schools had some computers before NEPAD e-schools computer lab, so the school was aware of the potential of computers, though not fully prepared in terms of trained teachers to take full responsibility in teaching using ICT facilities, but the school was pleased to take up the responsibilities whatever the case because we already knew the importance of computers in a school. (SPB March, 2011).

Interviews were also conducted with two teachers in school B to assess whether they had been given clear roles with respect to NEPAD e-schools programme, they both answered that no clear roles had been given to teachers.

#### 4.2.1.2 Access to ICTs

Data suggest that there is generally access to ICTs at school but access is restricted as the SPB revealed, the lab is used mainly for ICT lesson, few other subject teachers use computer facilities for teaching, facilities are not enough to make all students and all teachers have access, teachers go to the computer lab to prepare their lessons and search for more teaching materials, respondent ICTcB shared the same view that there is access but restricted to the timetable, though teachers can have access whenever they have time during the day and after classes but when there is a lesson going on they are restricted, students are restricted to have access only during ICT lesson.

Both teachers interviewed at SB reported restricted access to computers at school, TB2 reported only having access at school but TB1 reported having full access to computer facilities at school and even at home.

> I have full access to computer lab, I also had access to Internet but at the moment it is not available at school, but I have access to a laptop and modem that I bought myself that I can use at home (TB1 March, 2011).

The focus group interview with students revealed limited access to the computer lab, they reported only getting only two hours' access to ICT facilities at school, they said that they do not have any other access outside the computer lab, we need more time to use computers to practise what we learn and get more learning resources

Students had different views on how they access ICTs and Internet outside the school, SB1, SB6, SB3 reported having access to computers at home and cyber cafés during school holidays, all students were worried about non-availability of Internet, they said Internet helps them get more materials but it is not available. We wish the school can fix the problem of Internet again, we used to get more learning materials before, we used to communicate with other students but now no Internet is available.

#### 4.2.1.3 Use of ICT

The SPB was asked what according to his view is the role of teachers in utilising NEPAD e-schools programme to improve teaching and learning, the SPB commented that the ICT facilities are not enough, if equipments were enough and teachers and students have full access to use them as they like it would make a big impact but access is limited and ICT equipments are few compared to the number of students and teachers. At present all classes

have equal access (2 hours per week per class) from senior 1 to senior 6 of secondary in computer lessons only (timetable is only for computer lesson), therefore subject matter teachers do not get time to use the resources available on computers to teach their subjects. TB1 and TB2 indicated that teachers used computers mainly for teaching ICT lessons, for research purposes, preparing their examinations and preparing their lessons. Limited access to ICT and lack of time for ICT limits us teachers to use ICT very often.

The focus group interview with students at SB revealed that, they use ICT lab only for ICT lesson and we have limited time to use the facilities, they reported that they had only access for two hours per week studying ICT lesson and that they use computers to study ICT skills, basic software applications like word, excel, PowerPoint and basic ICT concepts. SB2 and SB6 said they use Internet to send and receive e-mails, search for information and chat. When students were asked if they used Internet for surfing websites for educational purposes, they said that they do not have Internet at school, even when Internet was there they had no time for Internet, they go to the lab to study ICT lessons only and that's what they only do at the lab. They are not allowed to surf the Internet as the teacher claims they cannot follow what he is teaching while they are busy surfing the net. Some students reported surfing the Internet at home and getting useful information for their learning purposes.

Asked if they are able to use relevant ICT tools and facilities they needed for doing school work and what the school has done to make the use of computers possible, students commented that no school work is done on ICT facilities, apart from 2 hours per week there is no more access and use of ICT facilities, one computer lab compared to the number of students cannot allow use of facilities as we want to use them.

#### 4.2.1.4 Training and professional development

The SPB was asked if he had received any training and what was the value of the training in terms of the NEPAD e-schools programme, he revealed that he together with two teachers at the school had received ICT literacy training form NEPAD and he received another training from the Ministry of Education in ICT school management, I see these trainings as of great value in terms of NEPAD e-schools programme.

> The ICT school management training was particularly important because it made me aware of my role as ICT champion at school; it made me aware how I can encourage

> teachers to use NEPAD e-schools programme more profitably for teaching and learning purposes.

Teachers are expected to be trained in order to be able to integrate ICT into their teaching and learning practices. Data from interviews revealed that there were different levels of ICT literacy among members of staff at school. Trainings were done in computer literacy by NEPAD and Ministry of Education, but the training only targeted a few teachers, only two teachers and school principal were trained. ICTcB reported that: "Some teachers who are recent graduates from higher learning institutions are computer literate, but those who graduated before the introduction of ICTs in higher learning institutions and have never had any training have no ICT literacy."(ICTcB March, 2011). TB2 shared the same view that there are teachers who have a high level of ICT literacy, mostly the young ones, but the old oneswho did not have a chance to have ICT literacy training either at higher learning institutions or trained at school have no ICT literacy at all and they do not want to use ICT because they do not have ICT literacy. ICTcB also commented that my expectations about the NEPAD e-schools were that:

> I expected training of teachers prior to provision of computers because teachers are the ones who will use the ICT facilities to teach, I also expected that with the introduction of ICT to school by NEPAD, teachers will teach better and students will learn better (ICTcB March, 2011).

All interviewees had the same concern, the importance of ICT and the responsibility of a teacher to handle the training of students and fellow teachers, they claim that a teacher already has more responsibilities and has no time to teach fellow teachers and they recommended that the Ministry of Education appoint teachers responsible for the use of ICTs and training of teachers in schools.

#### 4.2.1.5 Maintenance and support

There is no maintenance from NEPAD or from the Ministry of Education, when there is a problem the school hires a technician to do the maintenance, the SPB revealed that there is no maintenance arrangements, we do not have a technician and no budgets available to hire one. When there is a problem, the school has either to look for money from other school programmes to do the maintenance and if the money is not available, we just leave the equipment not attended to until there is money for maintenance. "This is a big problem because out of twenty computers we have only eleven working; the interactive white board

and a projector are not working, so access is getting more and more limited." (ICTcB March, 2011).

### 4.2.2 Improvements in teaching, learning and administration practices

#### 4.2.2.1 Teaching

The SPB was asked if the NEPAD e-schools programme has changed the way teaching takes place and if he considers that a positive change, SPB agreed that the programme has had an impact on teaching and learning. Teachers do their lesson preparation and presentation using ICT facilities, they research using Internet to get more teaching and learning materials, preparation and examinations and tests is now more easy and quicker and more privacy is maintained rather than typing examinations outside school or in the hands of a different person rather than the teacher.

The ICTcB concurred that he had seen both teachers and students gaining ICT skills that enabled them to use ICT facilities for teaching and learning. Interviewed teachers shared the view that teachers have gained ICT skills and knowledge that have uplifted their level of teaching.

TB1 and TB2, commented that it has increased ICT skills to both teachers and students, it has facilitated teachers to get additional resources from Internet and CD ROM, Computers have pre-installed content that teachers can refer to and communication and research is easy when Internet is available (TB1, TB2 March, 2011)

#### 4.2.2.2 Learning

Data from the focus group interview reveal that though there is limited access and there is no Internet, they have gained ICT skills, they can use applications like Ms Word, Ms excel, Ms PowerPoint and have knowledge on the use of Internet, and all students had the same view. A senior 5 student commented that: "we also used Encarta software to search for more materials related to our subjects, but now the software is uninstalled" (SB4 March 2011).

Students further commented that if they had access to Internet, they can get more materials but now there is no Internet at school. Some teachers are willing to teach their subjects using ICT but the equipments are not enough to allow them access anytime they feel like. If teachers can use projectors and smart boards students can follow easily their lessons.

### 4.2.3 Barriers/challenges affecting the use of ICT

Although data reveal positive effects of NEPAD e-schools programme, from the interview conducted in SB, a number of challenges were identified that hinders the effective use of ICT in the school, these are, there are few ICT facilities compared to students and teachers, trainings were short and were not very much helpful in terms of facilitating us help students, there is lack of a budget to upgrade the skills of teachers in ICT, the school has no budget to maintain the equipments, lack of Internet is another barrier, the school has no budget for Internet connection fee and as mentioned earlier, the school has no budget for replacement for damaged or old equipment

ICTcB shared the same view with the SPB but strongly put much emphasis on access to ICT facilities, teacher level of training in the use of ICT facilities in teaching. Both TB1 and TB2 interviewed strongly mentioned lack of relevant training, and lack of time to use ICT facilities and technical faults of the equipments as the most pressing challenges they face in the use of the NEPAD e-schools computer lab.

### 4.2.4 Future development of ICT in NEPAD e-schools

SB shared the same views with SA on future effective and efficient use of NEPAD e-schools, there is a need to have more access to ICT facilities, the Internet issue was mentioned by every interviewee therefore for future improvement Internet access should be availed, the budget should be available for maintenance and technical support, intensive training to teachers to be more skilled in ICT so that they can be competent and confident to teach their students is important, time and practice is important, teachers and students alike should be allowed more time to use the ICT equipments.

## 4.3 School C

The school was founded in 1957 and belongs to Kigali Archdiocese. The school is an urban school located in the suburbs of Kigali city in Nyarugenge district; the school has a population of 950 students and 43 teachers. The school was selected to participate in NEPAD e-schools demo in Rwanda. The school has 20 computers, five laptops for teachers, smart board, projector, print/copier/scanner, satellite TV and Internet all provided by NEPAD in November 2005. They also received a lot of materials to use ICT in subject teaching (some of these prepared by CISCO Teachers were trained by NEPAD in ICT skills. A fulltime ICT teacher has been employed by the school. Students are being taught ICT skills, two hours per

week as the ICT curriculum stipulates. Apart from initial 20 networked computers from NEPAD, the school also received other 20 computers that were meant for another NEPAD e-school, because the latter school has no grid electricity, CISCO NEPAD e-schools changed and put computers that can be powered by solar energy and gave the 20 computers to School C so that the school now has a total of 40 computers from NEPAD. The school also has other 10 computers from the Ministry of Education. Unlike the above two schools visited the school hired a technician on permanent basis to do the basic troubleshooting of the equipments The table below shows the number of equipments that exist at school both from NEPAD e-schools project and other sources.

**Table 4.3: ICT equipment at the School C both from NEPAD and other sources**

| Equipment at the project start | No. of NEPAD equipment | Equipment from other sources | Available and functional at the time of visit |
|---|---|---|---|
| Desktop computers | 40 | 10 | 36 |
| Server | 1 | | 1 |
| Laptops | 5 | | 4 |
| Printer | 1 | 1 | 2 |
| Scanner | 1 | | 1 |
| Photocopier | 1 | 1 | 1 |
| Projectors | 1 | 1 | 1 |
| white board | 1 | | 1 |
| Satellite TV | 1 | | 1 |
| Satellite dish | 1 | | 1 |
| UPS | 1 | | - |
| Internet | Installed | | Working |
| Learning content | Installed | | uninstalled |

### 4.3.1 Extent of the utilization of ICTs in NEPAD e-schools

This section relates to the findings of research sub question one and research sub question three on School C**.**

#### 4.3.1.1 ICT Vision, Policy and Leadership

The interview with the SPC revealed that there was no ICT vision and policy at school, there is a drafted user manual for the use of ICT facilities in the lab. The school has a dedicated person in charge of the computer lab, the role and responsibility of this person is to make sure the timetable is followed, open and close the lab at the time specified, make sure the lab is not misused, do the basic troubleshooting/maintenance and reporting the conditions of the equipments to the headmaster.

On the question whether the school was adequately prepared to take on the responsibilities associated with introducing ICT in their school, the SPC noted that; the school first needed to have teachers who are competent enough in ICT skills to be able to use ICT in teaching, the school needed to build capacity or hire permanent staff to make sure the equipments is functional whenever there is a technical problem, enough training was required not only in ICT skill but also in using ICT pedagogical integration.

Interviews with TC1 and TC2 both confirmed that there were no clear roles and responsibilities given to teachers in terms of NEPAD e-schools programme and that leaves them without knowing what they should or should not do. Both TC1 and TC2 share the view that no clear roles and responsibilities were given to them.

#### 4.3.1.2 Access to ICTs

Documents consulted and data from interviews show that there is access to ICT facilities at SC, but access is restricted by other factors like lack of enough ICT facilities as indicated by ICTcC who is in charge of computer lab at the school, he noted that teachers have access whenever they have time and even after school time, the computer lab is open for them to use from 19h00 to 21h00, students however are restricted only to the time allocated in the timetable which gives them access for two hours per week. But the school is flexible; for example a biology teacher can ask ICT coordinator to take his/her class in for lesson demonstration when there is no ICT lesson going on. The school computer lab has Internet, therefore teachers and students can have access "All classes have access two hours per week. Teachers can access the lab after school hours and use available content on computers to add on their textbook materials and prepare what they will teach their students."(ICTcC March, 2011).

Teachers interviewed noted that though there is access to the computer lab but they do not have much time to use the lab, most of all not even all teachers have ICT skills to use ICT facilities, the lab is timetabled for teaching ICT skills, some teachers who have ICT skills can also use the lab, but those without ICT skills do not use the lab and there are no arrangements in the timetable for them to learn ICT skills.

The focus group interview with students showed limited access to the computer lab, they revealed that they can get more resources for their studies if they have access to computer lab whenever they want, but they are restricted to access only once a week, they do not have

more practice and access to computer lab outside the timetable, When a question on where else they could have access and use of ICT tools and facilities outside of their normal school hours and if they had access to the Internet was posed to the group, SC6 said that he has no other access apart from the computer lab, most students said they have access to a computer and Internet at home and SC4 reported going to cyber cafés often in holidays. All students said they could improve their learning with ICTs if they had access to facilities and if they got more time to use ICT facilities.

#### 4.3.1.3 Use of ICT

All students use the ICT facilities, interviews with teachers on how they integrate computers into their lectures, lesson preparation, communication and research, they answered that, teachers who are computer literate used computers mainly for typing tests and exams for students and recording student marks and making student assessment reports but they also mentioned that some teachers use ICT facilities to prepare and present their lessons. On the integration of ICT into the curriculum the SPC revealed that some teachers use the resources available on computers to teach students, but few are skilled to do so, he noted that teachers integrate available resources to a small extent, few teachers use available content on computers, this is mainly because ICT facilities are few and students are many and another big issue is that teachers are not skilled to integrate ICTs into teaching. The computer laboratory is used mainly by ICT teachers to teach ICT skills and the timetable available is for teaching ICT lesson only, not for using ICT to teach other subjects but some teachers consult the content available for other subjects and complement their existing content. Some innovative teachers use the facilities after school hours for lesson preparation and search for more information regarding their teaching subjects.

Students interviewed in focus group were asked what they use computers and Internet for, what favourite activities they like to use computers for and how long they had access to the computer lab. Students noted that they had access for only 2 hours per week studying ICT lesson and what they do is to follow teachers instruction, they said they do not have more practise, they would like to have more time in the computer lab finding information related to our studies, but time is limited and ICT equipments are not enough for all of us to have access.

Students were asked if they are able to use relevant ICT tools and facilities they needed for doing school work and what the school has done to make the use of computers possible,

students commented that they do not do any school work on ICT facilities, its only teachers who use facilities for teaching, students are instructed to follow what they teach. Computers are few and the school has no way to make students have access any time because students from senior one to senior six have to rotate in the lab.

#### 4.3.1.4 Training and professional development

Both SPC and ICTcC agreed that ICT literacy of teachers was very low, for ICT to be integrated to improve teaching and learning at school, teachers must be ICT literate. Asked whether there were computer courses in place to upgrade the skills of teachers, the SPC noted that

> No budget and expertise is available at school to upgrade teachers' ICT skills, the Ministry of Education organised ICT skills training to teachers, and we got also training from NEPAD after installation of ICT facilities, but trainings are not enough to make teachers able to integrate ICT into curriculum, more intensive and relevant to ICT integration training is required 'not only mere ICT skills training which is also not enough' (SPC March, 2011).

Interviews with teachers on whether they had received any training that supports their teaching revealed that they had not received any training that support them in teaching, they said they had only received ICT skills training and had not received any other specialized training to support them in their subject-based teaching.

#### 4.3.1.5 Maintenance and support

NEPAD provided technical support during the first year of installation of ICT equipments, the school also hired a technician on full time basis who caters for maintenance and technical support of ICT facilities at school. Regarding maintenance of the NEPAD e-schools computers, SPC revealed that:

> …after the support from NEPAD ended, we decided to hire a technician on a full time basis, the technician is not capable of maintaining all equipments but he can do the basic troubleshooting and can identify what is faulty so that we can find expertise from outside (SPC March, 2011.)

There is no distinct budget for maintenance and technical support, the SPC revealed that "No support from government or NEPAD in terms of maintenance, when an equipment needs

replacement the school face a problem and sometimes the school just need to wait if they can get money from some other school budget activity (SPC March, 2011).

In terms of computer lab management, the hired technician, who also acts as a computer lab coordinator said that:

> I am the ICT coordinator as well as ICT teacher, I am the one who manages the computer lab and I report to the school principal whenever there is a problem with the equipment that needs maintenance (ICTcC interview March, 2011).

### 4.3.2 Improvements in teaching, learning and administration in NEPAD e-schools

This section provides findings on research sub-question two which asks the effects of ICTs on teaching and learning practices in NEPAD e-schools.

#### 4.3.2.1 Teaching

The SPC was asked if the NEPAD e-schools programme has changed the way teaching takes place and if he considers the change to be positive, he strongly agreed that there was a positive impact on both teachers and students and the whole school at large, the SPC noted that the trainings that teachers received helped them in their lesson preparation and presentation and this is a positive change and I think it has changed the way teachers teach and how students learn. Using a projector and interactive white board makes it easy for teachers to present their lesson to a large group of students without having to go to every machine where students are seated, Science teachers also use interactive white board to present their lessons but this is not on the timetable and it's not very often. Internet has facilitated teachers to search for more teaching and learning material.

Teachers TC1 and TC2 from SC both agreed that NEPAD e-school programme was of a great value to the school, they declared that the programme has widened their ICT knowledge and facilitated their work, TC2 noted that the NEPAD e-schools programme has added value to school, to teachers and students by giving them ICT skills required in today's work environment. Some of the teachers who are ICT skilled can easily prepare and present their teaching materials, it is easy and quick. The facilities like Internet have facilitated research and add knowledge and value to what one already knows and have provided easy communication with other teachers and students.

#### 4.3.2.2 Learning

Data on the impact on learning reveal that students learn differently with ICT, when students were asked if they learn differently with ICT they mentioned that they did. They reported that they get additional materials from Internet that is relevant to their subjects; they use Encarta software to search for more learning materials. Teachers are willing to teach their subjects using ICT but the equipments are not enough to allow them access any time they feel like. If there was more time and access to ICTs teachers could teach better and we could also learn better.

#### 4.3.2.3 Administration

The ICTcC agreed with the SPC that as ICTcC, he had noticed that both teachers and students have gained ICT skills that enabled them to use ICT facilities for teaching, learning and school administration.

The school administration is done better than before, records are kept and retrieved any time, student marks are recorded, saved and reports printed using ICTs, ICT have made teachers' work more presentable, faster, they can save their work and use it in future, in general ICT saves teachers' time (ICTcC March, 2011).

### 4.3.3 Barriers/challenges affecting the use of ICT

Lack of a budget to maintain the equipments, lack of Internet connection fee, lack of training or inadequate training programmes which are not very much helpful in terms of facilitating teachers help students, too many students compared to few equipments, were some of the cited problems schools face with the use of NEPAD e-schools programme.

TC1 and TC2 were concerned with the level of ICT competence, they questioned trainings provided, they said the trainings were given to only two teachers in the whole school, they said again that the training was not enough to make them be able to train their fellow teachers, they also emphasised time available for teachers to use the facilities, claiming teachers have their roles as subject matter teachers to prepare and teach many classes and they did not have time to use computer facilities

From focus group interview, students mentioned different challenges that they encounter in using NEPAD e-schools computer laboratory, some of the commonly mentioned challenges are: they share one computer when they are many, no time to practise what they learn,

computers are few and students do not have access to them any time they have time, they noticed that as time goes, computers are becoming fewer and fewer because some of the equipments are no longer working.

### 4.3.4 Future development of ICT in NEPAD e-schools

For the future effective and efficient use of NEPAD e-schools all interviewees had a common view on what could be done to overcome the challenges that limit the effective use of NEPAD e-schools ICT facilities and what they thought could be done to improve the situation if they were given the opportunity for improvement, they all mentioned that, there is a need to have more access to ICT facilities therefore there is need for more ICT equipments, , the issue of maintenance and faulty ICT equipments was mentioned by almost everyone, a budget should be available for maintenance and technical support, lack of skills was also another issue that all mentioned, provision of intensive training to teachers to be more skilled in ICT so that they can be competent and confident to teach their students is important, time and practice is important, teachers and students alike should be allowed more time to use the ICT equipments and lastly teachers are very important in the whole process, they should have full access to laptops to use even at home.

## 4.4 Issues from the Country Liaison Person (CLP)

The Country Liaison Person works in the Ministry of Education and is responsible among other things to oversee the implementation of NEPAD e-schools in the country.

### 4.4.1 ICT vision, policy and leadership

The country has both a Vision and an ICT policy, the vision is called vision 2020. The country also has an ICT policy called NICI policy and plan that was developed in the year 2000, the plan is being implemented in four phases of five years each, starting from the year 2000 to the year 2020. The subsector on education in the NICI policy and plan contains ICT in Education action items that education sector has to implement. Much emphasis of the sub-sector in the National ICT policy focuses on ICT in schools. However, CLP lamented that, although there is a national ICT policy and ICT in Education policy, the implementation of different initiatives that exist in education is not coordinated

There is an ICT in education committee that includes different stakeholders (public, private and civil society) represented on the committee, however these are not there on a daily basis,

they just come when they are called upon, mostly when there is a committee meeting (CLP interview March, 2011).

Therefore a monitoring and evaluation mechanism for the implementation of ICT in schools is still a problem because there is no permanent team with the necessary expertise responsible for monitoring and evaluation of those initiatives.

### 4.4.2 Access and use of ICT infrastructure

It is the central government and development partners that take a leading role in financing the acquisition of ICT infrastructure, training teachers in the use of ICTs and developing policies and strategies for these ICT in Education initiatives, but the schools which are the owners, implementers and users of the programme have no budget dedicated for developing capacity at the school level to sustain, manage and maintain the infrastructure. The initial training for teachers that was done was not enough, schools need to continuously build the capacity of teachers to be able to cope with the changing technologies, schools need to be able to constantly upgrade and maintain software and hardware (CLP interview March, 2011).

The CPL further said that ICTs are expensive, schools have no expertise and budget to keep ICT equipments functional and training of teachers adequately to be able to use ICT in teaching, some initiatives are just imposed on the schools that are not even prepared to take the responsibility, that's why some initiatives fail or do not achieve their intended objectives.

The importance of ICT in schools cannot be over emphasised, ICT in schools makes teachers' work easier and presentable, it makes students confident, think critically and work more independently without having to wait to be fed by teachers, ICTs can also provide more information and enable research, can provide better tools for file transfer and sharing and enables easy two way reporting and communication between teachers and school principal. The CLP said that the reason the teachers and school participating in NEPAD e-schools project need to use ICT was: "To learn basic computer skills and use computers as a tool to teach. Teachers and other school staff members expect the computer lab to offer them skills that will enable them to teach and administer the schools better" (CLP interview March, 2011).

### 4.4.3 Maintenance and technical support

The respondent suggested that due to the importance ICT can offer to improve teaching, learning and school administration, if given opportunity to change and improve NEPAD e-schools programme, government should put up a team that constantly visits schools to train and maintain ICT infrastructure until that time that a person able to maintain the equipments and train others is available at school, alternatively the government should set aside:

> A budget for upgrades and maintenance of the equipments and software and replacement of damaged equipments,….ICT equipments are not enough compared to the number of users at school and this makes the situation difficult for everyone to have access to them (CLP interview March, 2011).

## 4.5 Barriers for ICT use in NEPAD e-schools

### 4.5.1 Training and professional development

Confident and competent teachers are required in order to make a successful integration of ICT into teaching and learning in any school that has a vision for ICT use, according to the CLP, the initial training provided by the Ministry of Education is not enough to make teachers able to teach using ICT tools, more intensive and continuous training is required to make teachers able to use ICTs effectively, teachers therefore need to be more comfortable, confident and competent to teach using ICT.

When asked what kind of training the Ministry offers to teachers and how long the training was, the CLP reported that the trainings are short, not relevant because they are conducted by technical people, who do not have pedagogical knowledge (CLP interview March, 2011).

### 4.5.2 Maintenance and support

Functional, upgraded hardware and software are important if the use of ICTs is to succeed in every setting, in schools alike, ICT hardware and software need constant support and upgrades, from the respondent's observation, schools lack capacity in terms of maintenance of ICT infrastructure. The CLP reported that: "…they do not have expertise and budgets to do the upgrades and maintenance of hardware and software at schools and this may lead to the failure of initiative like NEPAD e-schools initiative" (CLP interview March, 2011).

### 4.5.3 Lack of ownership

The Ministry of Education claims having no capacity to cater for all schools in terms of technical support, the CLP said that the Ministry has only two ICT logistics officers, who cater for the support of the Ministry network and ICT infrastructure, but the schools also claim not to have the capacity and expertise, the CLP mentioned that:

There are many ICT initiatives in schools both primary and secondary, these two ICT officers at the Ministry of Education cannot support all the initiatives, but schools on the other hand claim to have no expertise and budgets to cater for the upkeep and upgrade of these ICT equipments, they claim it is the Ministry's initiative, the Ministry should provide a budget for taking care of these equipments (CLP interview March, 2011). Therefore you find that there is lack of ownership and this can lead to the failure of an initiative like NEPAD e-schools, claims the CLP.

## 4.6 Findings from policy analysis

The policies analysed during the study are NEPAD e-schools policy, Rwanda ICT policy and ICT in education policy. NEPAD e-schools policy is not written down but documents available give an overview of the purpose and objectives of NEPAD e-schools and targets, expectations from the implementation of the project.

### 4.6.1 NEPAD e-school program

The NEPAD was formed with the noble mandate to address challenges that Africa faces and bring Africa to the path of sustainable growth and development. This mandate was spearheaded by African leaders themselves (NEPAD, 2005). To address some of those challenges, one of the strategies was to broaden education opportunities through development and application of ICT infrastructure, the NEPAD e-schools initiative was therefore established to leverage the potential of ICTs to respond to challenges facing African secondary education system (Evoh, 2007).

To harness the implementation of NEPAD e-schools initiative, NEPAD established the e-Africa Commission, a NEPAD task team responsible for developing and implementing ICT programmes. The core task is to supervise the implementation, coordination and monitoring and evaluation at continental level (NEPAD, 2005).

The purpose of NEPAD e-Schools initiative is to equip young Africans with skills necessary to work and participate in the emerging information society and knowledge-based economy, provide teachers and school managers ICT skills to enhance teaching, leaning and facilitate efficient school administration and management (NEPAD, 2005)

The NEPAD e-schools demonstration project was established to gain knowledge and experience on how ICT can be implemented in schools across African continent. This would provide knowledge on the real circumstances, experiences, scenarios and requirements for the future implementation and rollout of NEPAD e-schools initiative. Other components of the policy were setting up of business plans that would provide information on all rollout requirements including funding requirements for the first phase rollout, monitoring and evaluation mechanisms for the demonstration project and framework for teacher training and professional development (NEPAD, 2005).

The NEPAD e-Africa Commission is a continental body, which coordinates plans and sets standards for the implementation of NEPAD e-schools programme at continental level, but the actual implementation rests with individual pilot countries/schools, whether the country has the capacity to sustain the implementation remains a question.

Monitoring and evaluation conducted by NEPAD e-Africa Commission showed some implementation challenges by individual countries. Some of the challenges were lack of both human and fiscal resources, lack of effective communication among project partners, inaccurate assumptions about ICT use in education in Africa, and lack of preparedness of some countries to participate (Farrell et al., 2007). The present study found that some of these challenges still exist and there is no mechanism in place to overcome them.

The present study found no written policy, implementation and sustainability plan set by NEPAD e-Africa commission for the countries to follow, either at the Ministry of Education or in schools, the Ministry of Education has not also developed any plan for the implementation and sustaining the NEPAD e-schools programme.

The targets set in the outline of e-school project are too ambitious, according to the agenda, it was envisaged that by the end of 2008 (within 5 years from the start of the project), each student graduating from an African high school will be ICT-literate and within 10 years, each African primary school graduating pupil will be ICT literate (NEPAD, 2005). From the

present study findings, not even those students that are graduating from the few pilot NEPAD e-schools in Rwanda are ICT literate.

### 4.6.2 Rwanda ICT policy (NICI 2010)

Rwanda ICT for Development (ICT4D) process started in 1998 with the support of the Africa Information Society Initiative (AISI) of the United Nations Economic Commission for Africa (UNECA), the process aimed at facilitating Rwanda's socio-economic development through the deployment and exploitation of ICTs within Rwanda's economy and society. Rwanda published its National ICT policy (National Information and Communications Infrastructure) in 2000; this policy was based on a document that was released in 1999 for the national debate the ICT-Led Integrated Socio-economic Development Framework (RITA, 2006).

The NICI (National Information and Communications Infrastructure) policy and plan is being implemented in four phases (5 year rolling plans). NICI plan one (2001-2005), NICI plan Two (2006-2010), NICI plan Three (2011-2015) and NICI plan Four (2016-2020). Every phase of the NICI plan has a goal to accomplish up until Rwanda 2020 when Rwanda aspires to have transformed itself into a middle-income country (RITA, 2006).

The Rwanda ICT policy aims at facilitating Rwanda's socio-economic development through the deployment and exploitation of ICTs within Rwanda's economy and society (RITA, 2006). The Government of Rwanda (GOR) recognises the role that ICTs can play in accelerating the socio-economic development of Rwanda towards an information-rich and knowledge-based economy. On the basis of this acknowledgment, the government committed itself to the implementation of a number of key policy initiatives aimed at facilitating and accelerating development, deployment and exploitation of ICTs within the economy and the society (RITA, 2006).

The National Information and Communications Infrastructure (NICI-2010) elaborate clearly the integration of ICTs in Education. The policy emphasises the use of education software and translating the software into the local Kinyarwanda language, as a strategy to avail relevant and quality education, the policy points out the development of e-learning content and teacher professional development in the area of ICTs in education, the acquisition of computer equipment for schools and the national School Net project to provide access to the Internet for schools are among other policy action items (RITA, 2006).

The education sub-plan in NICI 2010, being implemented by the Ministry of Education and its partners is based on the need

> To transform Rwanda into an IT-literate nation; to transform educational system using ICTs with the aim of improving accessibility, quality and relevance to the development needs of Rwanda and to improve the human resource development capacity of Rwanda to meet the changing demands of the economy (RITA, 2006:52).

The education sub-plan in NICI 2010 sets out a number of action items and strategies for ICT implementation, training strategies are mentioned in two ways, training of primary and secondary school teachers in ICT in education and training of critical mass of computer literate teachers, the policy supports this training strategy by setting out to establish a regional training and research centre. The policy also suggested development of computer curriculum for both primary and secondary education (RITA, 2006).

Other strategies and action items mentioned in the education sub-plan of NICI 2010 are the implementation of Education Management Information System (EMIS) to enhance the use of ICT in management of school related information and the development of a national electronic distance education program which will act as a supplement to existing school-based learning. This will support and enable in-service teacher training and facilitate lifelong and collaborative learning (RITA, 2006)

The Rwanda ICT policy aims to achieve the development of education initiatives for educational exchange programmes, implementation of ICT in schools using the Smart school concept as a technology platform for distance education and integration of ICT use in rural schools (RITA, 2006 & Farrell, 2007). This falls squarely in the NEPAD e-schools initiative.

It is clearly stated in the NICI policy that the implementation of the above mentioned policy action items will have a very significant impact on the development of the key sectors of the economy. "The development of the Rwanda information and knowledge economy will depend heavily on how much its resources are invested into promoting the deployment, utilization and exploitation of ICTs in the Educational Systems" (RITA, 2006 :81)

### 4.6.3 Rwanda ICT in education policy

In responding to the implementation of NICI-2010 planned actions in education sub-plan, MINEDUC tabled ICT in education policy in 2008. The Policy states the education sector mission as "creating a shared understanding for integrating ICT at all educational institutions,

at all levels, to support the development of better teaching and learning to equip students with the 21st century skills" (MINEDUC, 2008b:17).

ICT in education policy was also developed as a result of the workshop that took place in Kigali in 2008, the aim of the workshop was to "develop a Strategic Implementation Framework for creating a shared vision and understanding of how to best support the efforts of MINEDUC in the area of ICT in Education and the Education Sector Plan" (MINEDUC, 2008b:14). The workshop identified lack of ICT in education policy as one among the challenges facing ICT in education sector in Rwanda, other challenges included, teacher capacity development, infrastructure development, and content development. Participants were Ministry of Education officials, private sector representatives, local and international NGOs, the academia and Rwanda education alliance of world economic forum (MINEDUC, 2008b).

ICT in Education policy is mandated to facilitate the training of both primary and secondary school teachers in integrating ICTs in teaching and learning. It is expected that ICT in education policy will guide the implementation and integration of ICT in education. (Rubagiza, Were and Sutherland, 2011).

The policy seeks to accomplish the following objectives as set out in the policy document.

> Building a common shared understanding for what ICT in education means among all stakeholders; Defining synergy between different implementers of ICT in education; An enabling mechanism for prioritization of initiatives of ICT in education; Harmonization of efforts between the centralized and decentralized levels of the education system; Outlining the policy statements needed to achieve the vision; Leveraging Public Private Partnerships and support of Development Partners; Defining the demarcation lines between owners of the policy and the implementers; Strengthening Rwanda's effort to export ICT in education models to Africa in general and to the East African Community in particular (MINEDUC, 2008b:17-18).

Recognising challenges hindering the effective use of ICT in education system in Rwanda; the policy finds critical opportunities and strengths for the effective use of ICT in education. These include; political good will and support, country readiness, commitment to build the capacity at the ministry level and building multi stakeholder partnerships. Political will and support from His Excellency the president who is the ICT champion who drives ICT initiatives in Rwanda and other senior government officials' commitment to introduce ICT in

all sectors of Rwanda's economy is critical for effective use of ICT in education. The strong partnerships that Rwanda has developed, the initiatives to introduce ICT in education that are already in place, the commitment of the top government officials in driving the use of ICT in all sectors of the economy, give Rwanda an opportunity in the effective implementation of ICT in education (MINEDUC,2008b)

The policy document emphasizes that to ensure that the policy is comprehensive, eleven policy statements were identified and categorised according to the following statements:

> ICT in Formal Education; ICT in Non Formal Education; Access and Equity; Infrastructure; Curriculum, Content and Assessment; Training, Capacity Building and Change Management; EMIS Implementation; Management, Support and Sustainability; Monitoring and Evaluation; Multi Stakeholder Partnerships and Research and Development (MINEDUC, 2008b: 18)

Following the strategic approach for the implementation of ICT in education policy, the Ministry of education is given all powers to oversee the implementation, monitoring and evaluation of the policy at all levels of education. The ministry also has the power and responsibility to decide to delegate the powers, review roles and responsibilities of ICT in education policy implementation partner institutions. However, some of the prerequisites set in the policy for successful integration of ICT in education have not been fulfilled, the policy emphasised setting up a unit at the Ministry of education responsible for overseeing the implementation, making strategic plans for implementation, liaising with other institutions both public and private and monitoring and evaluation among other responsibilities. This unit has not been set up; therefore this makes coordination and implementation of the policy impracticable (MINEDUC, 2008b: 32).

The policy is expected to give a clear road map for increasing access to all, for teaching, learning, research and exchange and sharing of information, the policy also envisages to contribute to building ICT skills necessary for the employment in a knowledge based economy and ensure that "Rwanda has in place, an ICT driven process that supports an evidence-based decision making with respect to resource allocation, strategic planning and monitoring and evaluation of educational policy implementations" (MINEDUC, 2008: 34).

# CHAPTER FIVE

# DISCUSSION OF FINDINGS FROM NEPAD E-SCHOOLS CASE STUDY

## Introduction

In chapter four the researcher presented findings from three case study NEPAD e-schools. The findings illustrated issues related to the implementation of ICT in those schools. Themes that emerged from the previous chapter provide the basis for this chapter where the researcher discusses the issues around the implementation of ICT in the three case study NEPAD e-schools. Four themes that surfaced from this case study are: extent of utilization of ICTs in NEPAD e-schools, improvement in teaching and learning practices in NEPAD e-schools, barriers to the integration of ICTs in NEPAD e-schools and strategies for the future implementation of ICT in NEPAD e-schools.

This chapter also analyses and interprets the research findings in terms of research questions and literature review provided in chapter two. The study aimed to investigate how the Rwanda NEPAD e-schools project is achieving its objectives, purpose and outcomes. This will enable an analysis of success and barriers to the effective utilisation and integration of ICTs in Rwanda's NEPAD e-schools and investigate successes and barriers of e-schools and lessons for Rwanda ICT in education policy.

The analysis and interpretation of findings in this chapter is therefore conducted to answer four research sub-questions of this study. These four sub-questions are:

1. To what extent are the available ICT resources in NEPAD e-schools being utilised to improve teaching and learning practices?
2. What effect, if any, have the introduction of ICT had on teaching and learning in NEPAD e-schools in Rwanda?
3. What are the factors that facilitated the use ICT in Rwanda NEPAD e-schools?
4. What are the barriers to ICT integration in the NEPAD e-schools in Rwanda?

## 5.1 Extent of utilisation of ICTs in NEPAD e-schools.

This section will answer the research question one and question three, it covers the factors that favour the use of ICTs and how ICTs have been utilized in schools.

### 5.1.1 ICT vision, policy and leadership

The study showed that ICT vision, policy and leadership are critical if the implementation of ICT in schools is to be successful. The study found existence of national ICT policy and ICT in Education policy and both policies emphasise the use of ICT in schools, of the three case study schools only one had a vision that "All teachers and students of the school should be ICT literate in order to achieve the country's vision 2020" (SPA interview march, 2011). All three case study schools did not have ICT policies.

#### 5.1.1.1 ICT vision and Policy

The CLP lamented that, although there is a national ICT policy and ICT in Education policy, the implementation of different initiatives that exist in education are not coordinated. There is a need for a coordination mechanism for implementation of ICT in education initiatives as suggested by Kozma and Anderson that: The development of ICT policies in education is seen by most governments around the world as essential to the successful integration of ICT in education. They further argued that most governments have developed ICT in education policies and have invested a lot in providing access to ICTs in schools.

> "Countries … have all set national goals and policies that identify a significant role for information and communication technologies (ICT) in improving their education systems and reforming their curricula. Major investments have been made to increase the numbers of computers in schools and the networking of classrooms. Most countries, however, have a relatively small number of schools and teachers who are taking the lead in using technology to make changes in pedagogical practices that prepare students for the future" (Kozma &Anderson, 2002:1).

#### 5.1.1.2 ICT leadership

ICT leadership is essential in any successful integration and implementation of any ICT innovation in schools, leadership does not only apply to school principals where ICT is being implemented but collaborative leadership is essential, from government policies, Ministry of education policies and practices down to school principals, ICT managers and teachers. It was found in this study that one principal out of three principals in case study schools encouraged the use of ICTs in schools, planned for sustainability and maintenance of ICT equipments in schools, while others did not encourage and it was found that ICT equipments are not functioning. It can therefore be argued that the role of school principal is important in

implementation of ICT in schools, where school principal's influence is positive, there can be successful integration and where the influence is negative, the integration and sustainability becomes ineffective. To support the existence of ICT in education leadership, Calabrese (2002), noted that effective leadership is essential factor if a new innovation and implementation of change in schools is to happen. This is further supported by Anderson and Dexter, who argued that even though technology infrastructure is important factor in effective integration of ICTs in schools, ICT technology leadership is even more necessary (Anderson & Dexter, 2005). Therefore much as there may be access to infrastructure in NEPAD e-schools, schools still need an innovative technology leader and school principal is the key in this regard as pointed out by Han and Schiller that a school principal is the key to realise the potential of ICTs in schools; they act as special agents of change and main supporters of all innovations (Han, 2002; Schiller, 2003).

### 5.1.2 Access and use of ICT infrastructure

Although the country through partnerships has put much emphasis on providing ICT infrastructure to schools, training teachers in the use of ICTs and developing policies and strategies for these ICT in Education initiatives, the study show that access is restricted, students only have 2 hours per week to access the computer lab, teachers can access the computer lab whenever there is no lesson, but compared to ratio of population and ICT facilities available, teachers also have little time to access the facilities because computers labs are being used the whole day for students ICT lessons, but the lab is open to them after school hours

#### 5.1.2.1 Access to ICTs

The study found that some students have access at home and during school holidays but this access is only for students from well to do families. Results of the study reported lack of access to the Internet because it was not available at schools at the time of the study. The study stressed the ratio of students to ICTs facilities as a factor that results in less exposure to ICTs per student and hence one student may dominate using computers while others keep on watching, this dominance, Pelgrum argue may lead to inefficient teaching and learning since computers are not used evenly therefore all students may not benefit equally from the use of ICTs, he further argued that available ICT resources is a factor that affect the ICT use in schools (Pelgrum, 2001).

Teachers and students socio-economic perspective may affect the ICTs use at schools, the socio-economic context brings a divide, in well-to-do families, many students have access to ICTs at home, therefore they have skills and confidence to use these ICT technologies at schools (Muller, Sancho & Hernandez (2007) and in poor families students do not have these facilities. Bovee, Voogt & Meelissen (2007) argue that these disparities bring inequality and confidence issues in use of ICTs in schools. Students from higher income families have these ICT facilities at home, while students from poor families are introduced to these technologies for the first time and are therefore less familiar with their use. To ensure that teachers and students have timely access to ICT equipment at the schools, schools should employ more than one person to manage and supervise ICTs so that teachers and students can easily find a person who can help them have access to ICTs anytime they want.(Miller, Naidoo, van Belle & Chigona, 2006)

#### 5.1.2.2 Use of ICTs

The study demonstrated school principals' encouragement in the use of ICTs in their schools, they attended all trainings provided with their teachers, The SPC encouraged teachers to use computers even in the absence of budgets for technical support, he usually finds money to hire a technical person to maintain computers at school, during the time of the visit out of 40 computers available at school, 36 computers were working and only 4 were old and not working, this differed from other two schools visited, where a big number of computers were not working due to lack of technical support and budget to do the maintenance. This means that though these schools also mentioned that they encourage the use of ICT, but from what was found in the study, is that they do not. The study showed that teachers use ICTs for lesson preparation, doing research and getting more additional materials for teaching, doing administrative work like preparing exams and recording marks. Students also use ICT to learn ICT skills and searching for more materials on the Internet for their subjects. However as mentioned earlier, ICT equipments are few compared to people who need to use them, this limits their frequent use and therefore hinders effective use. Reynolds, Treharne and Tripp (2003), found different views on the use of ICTs in their study, some teachers agree that use of ICT increased their self-confidence and made significant improvement in their presentation of work, other teachers however reported that the use of ICT might be considered "an ineffective and time-wasting use of ICT—the production of 'neat nonsense'" (Reynolds, Treharne & Tripp, 2003:161). This shows different teaching and learning approaches from school to school and teachers' expectations of their students' approaches

and potential in the use of ICTs. In schools which were confident in using ICTs to raise standards, teachers reported their pupils being more resourceful, expressed themselves clearly, increase their autonomy while working with ICTs. Other teachers however were skeptical and said that pupils working independently may not be necessarily useful in learning "after all pupils' work independently when reading a book or producing a piece of work at home" (Reynolds, Treharne & Tripp, 2003:161).

### 5.1.3 Maintenance and technical support

One of the critical factor for the effective implementation of ICT in schools is to provide effective technical support (Seyoum, 2004). In order to guarantee efficient and effective implementation and integration of ICTs in schools, technical support should be an integral part of schools overall school plan, the plan should include installing hardware, operation, hardware maintenance, security and administration of network and supporting the whole school and teachers, no matter who provides the support, be a trained staff from within the school or external technical providers or both, in-school technical support is essential for ICT feasibility in any given school (Seyoum, 2004). This study revealed lack of technical support, all respondents reported that to keep equipments functional, government should put in place budgets for upgrades and maintenance of ICT equipments at schools and should train a permanent staff at schools to cater for maintenance and support of ICTs in schools. Lack of expertise and budgets to do the upgrades and maintenance of hardware and software at schools may lead to the failure of initiative like NEPAD e-schools initiative. In a study by OFSTED in Britain, it was discovered that professional and technical support was more efficient in schools where schools strategic ICT plan integrated the element of technical support and where the educators and technical support personnel had a good relationship (OFSTED, 2004)

### 5.1.4 Training and professional development

Training provided to teachers was found inadequate in this current study, teachers need more than ICT skills to be able to use ICTs in teaching, more relevant and timely training is required to make teachers able to use ICTs in their teaching. The study reported that training should be timely and relevant and teacher professional development in ICTs on a continuous basis was mentioned as an important element that can help teachers teach with ICTs. The study found that only few teachers had ICT skills in schools, only two teachers and the school principal were trained

> Teachers need to be trained on what is relevant to their teaching, they should be trained on what they need to use. The training should be scheduled well and give teachers time to familiarise before they can start applying them into teaching (SPA March, 2011).

The role teacher's play in teaching and learning paradigm is critical, with ICTs enabling the development of cognitive skills in examining problems, evaluating arguments and applying what is learnt (UNESCO Bangkok, 2004). Although teacher's role is crucial in teaching/learning process, their roles are often ignored under these changing circumstances and are often not consulted when deciding changes in teaching/leaning process. In reality, under these changing circumstances, teachers needs have to be assessed and find solutions to satisfy these needs. For the effective use technology to improve their teaching and learning practices, professional development of teachers is important (UNESCO Bangkok, 2004). To support the importance of teacher professional development, Afshari, Bakar, Su Luan, Samah and Fooi, (2009) suggest that for any effective technology in education, teacher professional development is central and teachers can only integrate technology into their teaching courses when professional ICT training gives them time to practice with ICT to teach, learn, collaborate and share with their colleagues (Afshari et al., 2009). The need to provide teacher professional development in ICT skills on a continuous basis was stressed by OECD (2001), emphasising strongly that without teacher professional development of ICTs on a continuous basis "effective technology integration into schools cannot succeed" (OECD, 2001:16)

### 5.1.5 Time

For any ICT in schools to be implemented successfully, availability of adequate time is critical, teachers need time to master the use of ICTs and generally teachers have little time for planning and prepare the use of ICTs, the time they have is for providing instruction and therefore school administrators must provide more time to teachers to become effective ICT users (Wanjala, Khaemba and Mukwa, 2001). The study found that time was a barrier to effective use ICT for teaching and learning, all respondents had the same view on the issue of lack of sufficient time. TA2 reported that:

> We are free to use computer lab but the problem is lack of time, we teach from 8h00 am to 13h00, break for lunch, resume teaching at 14h00 up to 17h00, you really do not have that much time for the computers, however the lab is open for us in the evenings from 19h00 up to 21h00 (TA2 March, 2011).

Wanjala, Khaemba and Mukwa (2001) further stated that teachers who begin using ICTs said that it creates more work for them and therefore they need more time to use ICTs in schools. TA1 reported that: “I teach Biology from grade four to grade six; I have to prepare teaching materials, prepare and mark assignments, prepare and mark examinations etc, so I find myself not having enough time for computers” (TA1 March, 2011).

To adapt a new innovation, implementers need more time to learn new knowledge and skills, implementers must also have time to adapt and integrate new innovation. The acceptance of an innovation itself does not bring about change, time is crucial for people to understand, adapt and develop abilities to use the innovation (Ely, 1990).

### 5.1.6 Funding ICT implementation

Effective integration of ICTs in schools require a sound financing policy frameworks for procuring appropriate hardware and software, acquiring teaching and learning tools, carry out the professional development of teachers, install and pay for Internet connectivity, upgrading, maintenance and replacement of hardware and software. However, other factors come into play when successful integration of ICT in schools is to happen, the teaching and learning environment has to be conducive, school leadership has to be supportive and teachers and students should have positive attitudes towards ICTs (OECD, 2001; Cawthera, 2001; UNESCO Bangkok, 2004). The study echoed the issue of budgets in successful implementation of ICTs in schools, more equipments are required if everyone is to have access, teachers need more training that is relevant and schools do not have budgets to train teachers, schools only rely on trainings provided by Ministry of Education which was not adequate to make teachers use of ICTs effectively in teaching, lack of technical support was also mentioned as a barrier and this is because of lack of expertise and budgets to hire technical personnel or train a person to do technical support on permanent basis at schools.

## 5.2 Transforming teaching, learning and school management in NEPAD e-schools

This section answers research question two on effects ICT has had on teaching and learning practices in NEPAD e-schools, findings of this study shows how ICT has transformed teaching, learning and research and school management in NEPAD e-schools.

The study show that the use of interactive white board and projectors facilitates and eased teachers work because they do not need to move to every computer to help student. It was found that a small number of teachers however used ICT facilities, those who used the

facilities are those that got training in ICTs. It was further found that most of all those ICT facilities were not working and teachers no longer use them and most teachers were not ICT literate and therefore were not willing to use even those ICT facilities that were available.

### 5.2.1 Teaching

Teachers are critical in any successful integration of ICT in education initiative, without dedicated teachers prepared and eager to learn and adapt new innovation like the use of ICTs into teaching and learning, the initiative is likely to fail. Findings by Chapman & Mahlk (2004) concur that using ICT in teaching motivates students to learn, makes students lessons more fun and increase children's autonomy and provide children the capacity to learn on their own pace. Teachers also perceived the use of ICT as a strategy that has reduced their administrative work and made teaching more interesting to them, ICT has provided teachers with tools for teaching and children's learning and this has made teachers work more of a facilitator rather than that of instructor (Chapman & Mahlk, 2004). The present study found that ICT was used mainly in administrative work and less on teaching and learning, and was used by only few teachers who are ICT literate

### 5.2.2 Learning

All students in the study, revealed that they have gained ICT skills, they said they can use applications like Ms Word, Ms excel, Ms PowerPoint and have knowledge on the use of the Internet. All students agreed that they can use Encarta software to search for more materials related to their subjects and this has been helpful, teachers also commented that with ICTs you find students coming to class prepared than before because of using ICTs. Some students said that the use of ICTs at school has provided them with skills and confidence that even in holidays they can use ICTs in Internet café and at home for those who have them at home. However due to lack of trained teachers this has not been realized in learning their subjects because most teachers are not ICT literate, schools lack technical support to keep the equipments functional, for example in all case study schools, the interactive white board and projectors were not working, therefore this affects teaching and learning.

The South African Institute for Distance Education (SAIDE) study reveals that ICTs provide learners with confidence and empowerment. Learners have developed love for the school, Students have learnt to work independently rather than waiting to be helped and fed by the teacher. ICTs enable learners to think critically, it prepares learners to develop life-long

learning habits, it helps them to access and synthesise information, evaluate and communicate the information and this prepares them for the 21st century world (Bialobrzeska & Cohen, 2003). Another impact of ICTs according to Cawthera is that ICTs make learning resources available to learners because of its ability to connect people; this makes access to education possible by connecting people and making learning resources available. This benefits developing countries particularly African countries where qualified teachers are scarce. (Cawthera, 2001). The access to information for learning is also supported by (Chapman & Mahlk, 2004) that computers and Internet supports constructivist learning by providing worldwide available resources and information that helps teachers and students to access information and construct meaning out of that information and this makes learners more independent, they do not wait to be fed by the teacher but can explore the learning material on their own (Chapman & Mahlk, 2004).

### 5.2.3 Research and Administration

This present study show that with the introduction of ICT in NEPAD e-schools, school administration and management is done better than before, time table is made and updated on computers, records are kept and retrieved any time. School administrative work is typed on computers, minutes of the meetings and other important documents are saved on computers for future reference and follow up, few teachers claim they can type their tests and exams using computers, they can make mark sheets and record their students marks, they can communicate to other teachers and look up for teaching information on the Internet, however those teachers interviewed were ICT literate who reported that their peers who are not ICT literate do not use ICTs at all either in administrative work or in research. From the study conducted by the SAIDE in schools in South Africa, both teachers and learners indicated that they have benefited from use of ICTs. They argued that computers save their time, fasten their work and make their work more presentable (Bialobrzeska & Cohen, 2003). ICTs also makes school administration more effective by providing better tools for data sharing and transfer, teachers can make their lesson plans, they can track students performance and the capability of computers to provide automated assessments and reporting makes teachers and administrators work more easy to administer and plan with confidence (Chapman & Mahlk, 2004).

### 5.3 Obstacles to the integration of ICT in NEPAD e-schools

The present research found obstacles to the implementation of ICTs in schools and this has hindered the implementation, some of the obstacles found in this research are:

#### 5.3.1 Insufficient funding

A critical barrier in ICT implementation in schools is lack of funds. Implementation of ICT in school requires provision of many computers with proper and relevant software and these can be too costly. Providing computers in every school classroom in poor schools in developing countries can be very difficult or even impossible given the nature of poverty and remoteness of schools in developing countries, such schools have trouble even in providing enough and proper textbooks to students. Although there has been initiatives funded by the governments, donors and NGOs that has provided ICTs in schools but the cost of maintaining and updating ICT equipments and software has proven to be very expensive, a huge sum of money is required to train teachers and paying for software licenses for schools (Cawthera, 2001; OECD, 2001; Baskin & Williams, 2006). The study found no budget for upkeep of ICT infrastructure at their respective schools, no budget to train teachers in ICTs, no maintenance and repair budget available at schools and when equipment is old, there is no budget to replace it with a new one. Therefore there should be plans to provide more funding for sustaining and supporting ICTs initiatives in schools if they are to achieve teaching and learning objectives. Costs are important in policy decision making and there is no information available on the Cost-benefit analyses for the implementation of NEPAD e-schools. Cost-benefit analyses was beyond the scope of this study, however recommendations for further research suggest a need to develop Total Cost of Ownership (TCO) or Cost-benefit analyses for implementation and sustainability of e-schools.

#### 5.3.2 Insufficient facilities

The study reported that the ICT equipments are not sufficient given number of people who need to benefit from them, one computer lab with 20 computes is not enough for the big number of students at schools, therefore it was found that access and use is limited because of lack of sufficient ICT facilities. Evidence demonstrate that schools with enough and good quality ICT resources, demonstrate a good practice in the use of ICTs (Mumtaz, 2000), and absence of good quality software and computers can limit what teachers and students can do with ICTs in classroom. BECTA also highlights the importance for schools to be well

equipped with enough and good quality ICT resources, in their publication Primary Schools ICT standards (BECTA, 2003). The research investigated relationship between ICT use in schools and pupils achievements in national examinations and found out that schools that were well resourced in ICTs outperformed those schools that were not well resourced with ICTs.

### 5.3.3 Lack of personal access for teachers

All three schools revealed lack of personal access for teachers, teachers have access to the school computer lab only after school hours or during the school hours but when there is no class going on and this is not always guaranteed because the lab is always occupied because it is timetabled for all classes from senior 1 to senior 6, for teachers to realize the effective use of ICTs they said they need personal access at home. Personal access to laptops at home is important, it gives a teacher more time to prepare and gain more confidence and skills to use ICT for their personal use and for teaching. The relationship between personal access to ICTs and teachers confidence was also found by (Guha, 2000; Cox, Preston & Cox, 1999), the result of their study showed that teachers who were regular users of ICTs demonstrated more confidence in using ICTs and as a result they develop positive attitudes towards ICT, they develop less fear in using ICTs and see ICTs as a valuable tool for both their own personal use and for teaching purposes.

### 5.3.4 Insufficient skills and confidence

The study highlighted the need for ICT skills possessed by teachers mainly, it was found out that training provided to them was not enough to give them confidence and skills to be able to apply it into teaching, respondents requested that a more timely and relevant training be provided if teachers are to be competent and confidence in teaching using ICTs. Many teachers are anxious and not confident in using ICTs in front of students who perhaps they think are more ICT skilled than they do, those teachers who consider themselves unskilled or not well skilled will try to avoid using ICTs in front of students. Lack of confidence was also echoed by BECTA (2004), it was found that low confidence and low skilled teachers in the use of ICTs always expect things going wrong and therefore may avoid using ICTS, also a teacher with low ICT confidence may refuse to take part in trainings probably because of fear to be embarrassed in front of colleagues (BECTA, 2004). Students who have access to ICTs experience daily use and interaction with new technologies, put pressure and demands on teachers, expecting them to be knowledgeable in the area of ICT usage. This is a barrier for

teachers who may be less skilled and less confident in using ICTs and may choose to avoid using ICTs altogether (Guha, 2000). Confidence in the use of computers and lack of computer skills by students is another obstacle that was found in the study by Frank, Reich & Humphreys (2003), they found that some students were struggling with technical difficulties; lack of computer skills which makes them became afraid of touching the computers .Teachers support to students understanding and use of computers is important for the learners to understand the use of computers in classroom context. Lack of such understanding may lead to students not to use these computers as learning tools. Teacher's guidance is seen by Baylor and Ritchie (2002) as an important for learners to improve their performance using computers, both in learning skills and involving them in other activities.

### 5.3.5 Insufficient technical support

Technical support was a top barrier in the study, the study found lack support both technical and administrative, schools have no expertise to maintain and upgrade its ICT facilities and most of the times you find equipments kept not functional for long time until the schools gets a budget to hire an external technician, this hinders everyday use of ICTs, the suggestion was that schools should hire/train a technician on a permanent basis to maintain the equipments. Teachers anxiety that something might get wrong during the process of using ICTs is a major barrier that prevent teachers from using ICTs, when a teacher expects technical faults with ICT equipment and does not have any available technical support, the teacher will have less confidence in using ICT for teaching and this may cause teachers to avoid using ICTs in future (Bradley & Russell, 1997). The issue of technical support is further emphasised by Snoeyink and Ertmer, 2001, they found out that while trying to use computers and cannot perform the task they intended to do due to technical problems, teachers would then avoid using the computer, this therefore underline the need for availability of qualified and competent technical personnel in schools to carry out technical support on a permanent basis (Snoeyink & Ertmer, 2001)

### 5.3.6 Insufficient time

A barrier that prevents teachers to make full use of ICT is lack of sufficient time needed to fully accomplish their teaching tasks; they lack time to prepare lessons, lack time to research teaching materials (Fabry & Higgs, 1997). They further pointed out that new skills like learning new technology requires time and yet teachers have a lot of tasks to do at schools

like lesson preparation, teaching, attending staff meetings, raising with other staff and parents and therefore are left with little or no time to experiment with ICTs (Fabry & Higgs, 1997).

Lack of time is a barrier that was evident in the study, the study found that teachers have other many responsibilities to accomplish at school, like preparing lessons, teaching, preparing tests, assignments and exams and mark exams and other many activities, they complained that they do not have time to learn about ICTs or attend trainings in ICTs. Some teachers said ICTs can help them accomplish some of those tasks but time to use ICT is also limited, because even access to ICTs is a problem, because whenever a teacher is free to use ICT facilities, there is always a lesson going on. Evidence of lack of time by teachers to use ICTs is provided by Cuban, Kirkpatrick & Peck (2001), they found out that teachers lacked time to use ICT fully into their teaching; teachers said they needed longer time to prepare lessons by searching materials on web portals and online materials and to undertake trainings. This problem did not apply only to teachers who do not use technology very often but similar complaints applied to those teachers who attempted to make full use of technology into teaching, as they had to work long hours in order accomplish the successful integration of technology into their lessons.

### 5.4 Strategies for future implementation of ICTs in NEPAD e-schools

The previous section identified barriers for effective use of ICT in schools, these barriers need strategies so that ICTs can be used effectively in schools. This section discusses some of the future implementation strategies that were suggested by the study.

#### 5.4.1 ICT in Education policy

For ICT to be effectively implemented in schools there is a need for a vision, policy and planning mechanisms, results from the study show that there is Rwanda ICT policy and ICT in education policy but there are no school level policies and school vision on ICT, absence of School level ICT vision, policy and implementation plans can lead to uncoordinated and poor implementation of such good initiatives. In future implementation of an initiative, a clear vision, policy and implementation plans should be in place at all levels to support the implementation. In support to the existence of a vision, Ertmer (1999:54) stressed that, "A vision gives us a place to start, a goal to reach for, as well as a guidepost along the way". Farrell and Wachholz (2003) also support the argument of existence of national ICT policies

and suggested that a key element of implementing and integrating ICT in schools is providing favourable national policy framework, they stated that:

> "Policies are an important ingredient of any leadership and management process…. A policy framework provides a vision of a desired end outcomes, it defines the results that need to be achieved in order to reach those ends, and provides guidelines for how the results are to be achieved" (Farrell & Wachholz, 2003:266).

### 5.4.2 Sustainability, maintenance and support

It was found out that all school principals encouraged the use of ICTs in their schools, they attended all trainings provided together with their teachers, The SPC encouraged teachers to use computers even in the absence of funds for maintenance and technical support, he usually finds money to hire a technical person to maintain computers at school, during the time of the study out of 40 computers 36 computers were working and only 4 were old and not working, different from other two schools visited, where a big number of computers were not working due to lack of technical support and budget to do the maintenance. Respondents proposed that for ICT facilities to be sustainable budget should be provided to cater for upgrades, maintenance and replacement of old ICT equipments. This view is supported by OFSTED study in Britain which discovered that professional and technical support was more efficient in schools where schools strategic ICT plan integrated the element of technical support and where the educators and technical support personnel had a good relationship (OFSTED, 2004).

### 5.4.3 Teacher professional development, quality and relevance of trainings

The importance of ICT in teaching and learning has been recognised by many countries and they have planned and provided ICT training for teachers. Although many teachers complain that the training provided to them is not adequate to prepare them to use ICT effectively in teaching and learning, there is consensus that efforts has been made to train teachers in ICTs and train them in using ICTs as tools to enhance their teaching and learning (Jung, 2005). To emphasise on the importance of ICT teacher training, Baylor and Ritchie carried out a study and found out that teacher training and professional development have major influence on the best use of ICTs in the classroom. They continue to argue that teacher trainings in ICTs often focus on ICT basic literacy skills and less on using ICT as tools to enhance teaching (Baylor & Ritchie, 2002). For the future effective and efficient use of ICTs in the NEPAD e-schools the study emphasised the importance of having skilled and confident teachers in the use of

ICTs, the study argued that provision of intensive, ongoing and relevant training to teachers is important for teachers to integrate ICTs into their teaching practices.

### 5.4.4 Access to ICTs and Internet

For the future effective and efficient use of NEPAD e-schools, the study suggested that to overcome the challenges that limit the effective use of NEPAD e-schools ICT facilities, there is a need to have more access to ICT facilities and high speed and reliable Internet. Studies in the field of ICTs have shown that ICTs have become essential tools in today's information age; computers have become motivating tools in teaching and learning (OECD, 2001, Watson, 2001). The information delivery services through the Internet have become cost-effective, collaboration and distance learning more than ever thought of (Bauer & Kenton, 2005, OECD, 2001).Therefore for effective integration and implementation of ICT in schools, ICTs mostly the use of computers and the Internet is critical.

### 5.4.5 Monitoring and evaluation

Monitoring and evaluation mechanism for the implementation of ICT in schools was a problem mentioned in the study; it was found that there is no permanent team with necessary expertise responsible for monitoring and evaluation of ICT in education initiatives. "Ministry of Education just survey what is being done but no tools and expertise to monitor and evaluate the process." (CLP interview March, 2011). A monitoring and evaluation mechanism should therefore be in place in future if the implementation of ICT in education initiative is to succeed. For ICT in education projects to be successful and sustainable, Rusten pointed out that monitoring and evaluation is fundamental. He further stressed that monitoring and evaluation activities can be organized in two parts, first part is project implementation and the second part is project impacts Rusten (n.d). Monitoring and evaluation mechanisms should be in place so that improvements in policy and implementation can be reviewed and improved upon.

### 5.4.6 Ownership

The capacity to cater for all schools in terms of technical support was found as a big issue from the Ministry, the CLP said that the Ministry has only two ICT logistics officers, who cater for the support of the Ministry network and ICT infrastructure, the study also found that the schools also claim not to have the budget, capacity and expertise, therefore you find that there is lack of ownership and this can lead to the failure of an initiative like NEPAD e-

schools,. For future implementation of ICTs in schools, a mechanism for ownership should be in place, a clear ownership strategy should be in place so that every institution knows their responsibility. Rwanda ICT in education policy supports the idea of having a holistic ownership and sustainability of ICT in education initiatives, it emphasises stakeholder ownership at all levels.

> The responsibility and concern with ICT extends to all stakeholders ... all educational institutions at all levels and departments have to be involved and kept abreast with the proper setup and utilization of ICT facilities, …as well as synergizing efforts and capitalizing on the each other's achievements for a holistic impact on education (MINEDUC, 2009:28).

## Conclusion

This chapter is undertaken to discuss and present analysis of the research findings from the data collected from interviews and documentary analysis. The literature review identified a number of factors that favour or hinder the use of ICT which was also evident in the research findings of this study. It was found that generally the attitudes towards ICT use in the three case study NEPAD e-schools was positive, but more work is still required to keep on supporting and encouraging teachers' in integration of ICT in schools.

Drawing on lessons from NEPAD e-schools project since its inception and considering the implementation opportunities and challenges found in the monitoring and evaluation report of the demonstration project, the study found that NEPAD e-schools project has made efforts to introduce ICT in African schools and Rwanda in particular to improve and enhance education. The study found remarkable increase in students' competence, ICT competence for teachers and confidence in using computers, ICT integration into teaching and ability by both teachers and students to research and get more materials. However barriers have been found to hinder the effective implementation of the project, lack of policy alignment, lack of ownership, insufficient funding for ICT access and connectivity, teacher training and professional development, technical support, time dedicated to the use of ICTs and teacher attitudes and skills. These lessons from the NEPAD e-schools project in this study can be a basis for Rwanda to adapt its ICT in education policy and national ICT policy or revise strategies to enhance the opportunities that are already available and find solutions to the barriers mentioned so that implementation and integration of ICT in Rwandan schools can be more effective.

# CHAPTER SIX

# CONCLUSIONS AND RECOMMENDATIONS

## Introduction

This chapter presents a synopsis of results and conclusions obtained from the study. It suggests recommendations for policy and practice and areas for further research for the effective utilisation and integration of ICTs in education in the NEPAD e-schools and other ICT in education initiatives, in Rwanda in particular and in other African countries. The results and conclusion are generalised to the NEPAD e-schools study population of students, teachers, ICT coordinators, school principals.

The purpose of this study was to investigate how lessons from the NEPAD e-schools project are useful for the Rwanda ICT in education policy and Rwanda ICT policy. The analysis and investigation of success and barriers to the effective utilisation and integration of ICTs in Rwanda's NEPAD e-schools were made and recommendations and lessons for Rwanda ICT in education policy and NEPAD e-schools policy and practice are based on the following research questions.

The main research question for this study is: How are the lessons from the NEPAD e-schools project useful for the Rwanda ICT in education policy and the national ICT policy?

To address the above question, sub-questions are posed to give extra insight to the research main question

1. To what extent are the available ICT resources in NEPAD e-schools being utilised to improve teaching and learning practices?
2. What effect, if any, has the introduction of ICT had on teaching and learning in NEPAD e-schools in Rwanda?
3. Which factors facilitated the use of ICT in Rwanda NEPAD e-schools?
4. What are the barriers to ICT integration in the NEPAD e-schools in Rwanda?

## 6.1 Summary of key findings

The study identified strengths and weakness of existing policy and practice in implementation and integration of ICTs in selected NEPAD schools. These strengths and weaknesses inform the conclusions and recommendations of this study.

### 6.1.1 Strengths and weaknesses of existing policies

**NEPAD e-schools**

The NEPAD was formed with noble mandate to address challenges that Africa face and bring Africa to the path of sustainable growth and development. This mandate was spearheaded by African leaders themselves (NEPAD, 2005). To address some of those challenges, one of the strategies was to broaden education opportunities through development and application of ICT infrastructure, the NEPAD e-schools initiative was therefore established to leverage the potential of ICTs to respond to challenges facing African secondary education system (Evoh, 2007).

To harness the implementation of NEPAD e-schools initiative, NEPAD established e-Africa Commission, a NEPAD task team responsible for developing and implementing ICT programmes. The core task of the team is to supervise the implementation, coordination, monitoring and evaluation at continental level (NEPAD, 2005).

The purpose NEPAD e-Schools initiative is to equip young Africans with skills necessary to work and participate in the emerging information society and knowledge-based economy at both primary and secondary level and to exploit the potential of ICT to improve and enhance education in Africa and provide educators and school administrators with ICT skills to enhance teaching, learning and facilitate efficient school administration and management (NEPAD, 2005).

NEPAD e-Africa Commission adopted a holistic approach for planning and execution of the NEPAD e-school programme, that included provision of ICT infrastructure, teacher training in ICTs, developing curriculum and digital content, community involvement and ownership of the process, creating partnerships and issues pertaining to finance and sustainability of the programme (e-Africa commission, n.d).

One of the major weaknesses of the NEPAD e-schools programme is that there is no written policy for participating countries or schools to follow, although there is a set of targets. These targets are:

The NEPAD e-Africa Commission set delivery targets, that within 5 years of start date of implementation of e-schools ( from 2005), all African secondary schools will have turned into NEPAD e-schools and all African primary schools will turn into NEPAD e-schools

within 10 years from the start date. Their estimate is that 600,000 schools in Africa both rural and urban will benefit from NEPAD e-schools programme within 10 years of implementation (Kinyanjui, 2003). The study found that this is not realistic, from 2005 to date (2011) only sixteen African countries has the NEPAD e-schools programme and only six secondary schools benefited in those countries and yet the target set that by 2010 all African secondary schools will turn into NEPAD e-schools has not been achieved.

It was envisaged that by the end of 2008 (within 5 years from the start of the project), each student graduating from an African high school will be ICT-literate and within 10 years, each African primary school graduating pupil will be ICT literate (NEPAD, 2005). The targets set in the outline of the e-schools project were too ambitious. From the study findings, not all secondary schools have been benefited in Africa as targeted and none of the primary school in Africa has benefited from the e-schools programme, so the targets are not achievable.

As noted in the study and from the literature review, without policy direction, implementation and integration of ICTs in schools may not be sustained and achieved and the purpose and targets may not be reached.

**Rwanda ICT Policy**

The NICI policy and plan envisage to make Rwanda an IT literate nation and build a modern educational system which supports the deployment and delivery of ICT in educational services, the policy emphasise the importance of teacher ICT skills, professional development and hands on teacher training and practical skills to enable teachers to implement ICTs into their lesson plans, adequate access to ICT infrastructure and connectivity, available and on time technical support and most importantly initial funding to sustain all the above for the effective ICT in education delivery. The study however found that the policy has not taken proper care of the above issues and they are still barriers to effective use of ICT in education in Rwanda (RITA, 2006).

Although the government of Rwanda has formulated a national ICT policy and ICT in education policy but the policy documents were not circulated to schools, the policies are not known by schools which are supposed to be implementing these policies, and these policies are therefore not practicable. The schools were also found to have no guidelines on how to use the NEPAD e-schools ICT equipment.

**ICT in education policy**

ICT in education policy was tabled in 2008 in response to the implementation of NICI-2010 planned actions in education sub-plan. ICT in Education policy is mandated to facilitate the training of both primary and secondary school teachers in integrating ICTs in teaching and learning. It is expected that ICT in education policy will guide the implementation and integration of ICT in education. (Rubagiza, Were and Sutherland, 2011).

The effective delivery and integration of ICT in education has been hindered by previously lack of ICT in education policy, lack of ownership, lack of planning and coordination. Recognising these challenges; the policy finds critical opportunities and strengths for the effective delivery of ICT in education. These include; clear political will and support, commitment and readiness to build the capacity at the Ministry of education level and existence of multi stakeholder partnerships. These opportunities give Rwanda an opportunity to effectively implement ICT in education (MINEDUC, 2008b)

The policy document covers the following policy statements to ensure that the policy is comprehensive: ICT in formal and informal education, infrastructure, management and support, content and curriculum, access and equity, training and capacity building, research and development, partnership development, implementation of EMIS and monitoring and evaluation.

The policy is expected to give a clear road map for increasing access to all, for teaching, learning, research, exchange and sharing of information, the policy also envisage to contribute to building ICT skills necessary for the employment in knowledge based economy and ensures that "Rwanda has in place, an ICT driven process that supports an evidence-based decision making with respect to resource allocation, strategic planning, and monitoring and evaluation of the educational policy implementations"(MINEDUC, 2008:34).

The policy which was developed in 2008 is still in draft format and has never been approved by the parliament, this renders its effective implementation questionable.

The aim of this study is to lead the researcher to provide lessons for NEPAD policy guidelines for national ICT policies and ICT in education policies for Rwanda and other African countries. The researcher will therefore explore cases of education challenges that face three other African countries that are also part of NEPAD e-school programme so that

the recommendations of this study can be generalised to other NEPAD e-schools countries. The countries in this case are South Africa, Kenya and Namibia.

**South Africa**

South Africa has a school going population of 14,167,086 enrolled in all levels of South African education system. The 2007 statistics also show that South Africa has 35,231 education institutions and a total of 452,971 teachers and lecturers. The breakdown shows that there are 26,065 ordinary schools and 9166 other educational institutions. Ordinary schools consist of 15,358 primary schools, 5670 secondary schools and 5,037 combined and intermediate schools. Primary going pupils are 6,316,063, secondary has 3,831,937 students and combined and intermediate schools has 2,253,216 students (South Africa, 2011)

Challenges facing education in South Africa are high Illiteracy rates, shortage of qualified teachers, and challenge of recruiting and retaining educators, most schools are under-resourced, under-supplied, and over-crowded (Isaacs, 2007a). ICTs can facilitate to solve these challenges by using the Internet and electronic resources and distance education and training to overcome the high illiteracy rates and shortage of qualified teachers and school-based lack of resources. The use of the internet and electronic resources can also facilitate acquisition of more learning materials to supplement and complement to the under-resourced and under-supplied problem.

**Kenya**

As of 2004, there were 7.2 million students in public primary and 300,000 at community schools in Kenya enrolled in about 15,000 primary schools. The secondary section had 620,000 students attending 3,000 schools, there were more than 60,000 students enrolled in middle-level colleges attending more than 250 colleges and Kenya had 24 universities ( 7 public and 17 private) which enrolled about 50,000 students (Ministry of Education, Science and Technology, 2004).

The main challenge facing Kenya education is low enrolment rates, mostly children in Arid and Semi-Arid Lands and children in urban slums, lack of enough classrooms. Higher education also faces a similar challenge of limited and poor facilities, leading to low transition rates form secondary to universities (Ministry of Education, Science and

Technology, 2005). Other challenges facing Kenya education system are issues of quality, access, equity and curriculum relevance (IPAR, 2008).

It has been found in this study and in the literature review that ICT can provide support in solving the issue of lack of infrastructure, overcrowded classrooms and high student - teacher ratio by using web technologies and online learning, ICT facilities like computer software and the internet can be used to access wide range of materials for both teachers and students self learning. Students with special needs can also benefit from using special needs software to ease their learning. The Internet and electronic resources and distance education and training can be used to overcome the high illiteracy rates and shortage of qualified teachers. Lack of enough textbooks can also be supported by the use of the internet and other electronic educational resources

**Namibia**

Namibia has a school going population of around 55,000 children, 1550 schools (of which 100 are private) and 19,000 teachers. It has seven vocational training centres, three agricultural colleges, four education colleges, one Police College and Namibia College of Open Learning. Namibia higher education is provided by the University of Namibia and Polytechnic of Namibia (Isaacs, 2007b).

Although there has been remarkable transformation in Namibia's education system since independence, there are challenges as well, the national report on development in education in Namibia show that the quality of education is poor, human resources are inadequate leading to unemployment and underemployment (Republic of Namibia, 2004). Lack of qualified teachers both in primary and secondary is also a challenge, overloaded and not up to standard curricula and shortage of textbooks (IRIN Africa, 2011). Challenges facing education in South Africa, Kenya and Namibia are entirely the same; the support ICTs can offer to solve education challenges in both South Africa and Kenya can also apply to Namibia's challenges.

## 6.2 Strengths and weaknesses of existing practice

In the view point of the three policies discussed earlier, the NEPAD e-schools, Rwanda ICT policy and ICT in education policy, the study found strengths and weaknesses in implementation and integration of ICTs at the three NEPAD e-schools, the practical findings are therefore briefly discussed here.

### 6.2.1 Teaching and learning

The study showed that the use of a white board and projectors facilitates and ease teachers work because they do not need to move to every computer to help student. Teachers have used ICT facilities to access more resources from computers and Internet that can supplement or update what they already have and what is available with other teachers or schools elsewhere. All students agree that they have gained ICT skills, they can use applications like Ms Word, Ms excel, Ms PowerPoint, emailing and web browsing . All students agreed that they can use Encarta software to search for more materials related to their subjects and this has been helpful, teachers also commented that with ICTs you find students coming to class prepared than before because of using ICTs.

### 6.2.2 Access and use of ICT

The study found that where there is access to Internet, teacher's use Internet to search for additional materials for teaching and communication. Study show that teachers use ICTs for lesson preparation, doing research and getting more additional materials for teaching, doing administrative work like preparing exams and recording marks. Students also use ICT to learn ICT skills and searching for more materials on Internet for their subjects. It was further found that of the three case study schools only one school had access to Internet, which means that there is lack of Internet access in two schools. The study found that where there are enough resources like working computers and Internet there is a fair use of ICTs and where there are no or little resources, there is a limitation in the use of ICTs.

### 6.2.3 Training and professional development

Teachers reported having ability to use some of the basic computer programmes and there is a remarkable confidence in using those tools, however the study found that training provided to teachers was not enough; teachers do not only need ICT skills to be able to use ICTs in teaching, more relevant and timely training is required to make teachers able to use ICTs in their teaching. Teacher professional development in ICT on a continuous basis is important elements that can help teachers teach with ICTs. It was further found that training was only given to few teachers and the training focused on basic ICT basic literacy and not on the pedagogical use of ICT, this limits the use of ICT in teaching and learning.

### 6.2.4 Administration and management

The study showed that school administration is done better than before, time table is made and updated on computers, and records are kept and retrieved any time. School administrative work is typed and saved on computers, minutes of the meetings and other important documents are saved on computers for future reference and follow up, and therefore all respondents agree that the use of ICT eases school administrative work.

### 6.2.5 Planning the use of ICT in schools

Although Rwanda has a national ICT policy that elaborates clearly the integration of ICTs in education, there is no clear implementation plan to sustain different ICT in education initiatives including NEPAD e-schools initiative, the policy should therefore be revised to include the whole planning, budgeting, building capacity, sustainability and implementation of ICT in education initiatives.

### 6.2.6 Funding ICT implementation

It was found in the study that there was lack of funds for ICT in case study schools, the study reported that more equipments are required if everyone is to have access, the need more training that is relevant to teaching and learning with ICT was an issue, schools only rely on trainings provided by Ministry of Education which is ICT basic training not useful for the use of ICTs in teaching, lack of technical support and expertise and budgets to hire technical personnel or train a person to do technical support on permanent basis at schools was also evident in the study.

### 6.2.7 ICT leadership

ICT leadership is essential in any successful integration and implementation of any ICT innovation in schools, leadership does not only apply to school principals where ICT is being implemented but collaborative leadership is essential, from government policies, Ministry of education policies and practices down to school principals, ICT managers and teachers. It was found in this study that some principals encouraged the use of ICTs in schools, planned for sustainability and maintenance of ICT equipments in schools, while others did not encourage and it was found that ICT equipments are not functional. Where leadership was effective, the integration was successful that where leadership does not encourage the use of ICTs.

### 6.2.8 Maintenance and technical support

To keep equipments functional, the study revealed that government should put in place budgets for upgrades and maintenance of ICT equipments at schools and should train a permanent staff at schools to cater for maintenance and support of ICTs in schools. Findings further reveal that schools do not have expertise and budgets to do the upgrades and maintenance of hardware and software at schools and this may lead to the failure of initiative like NEPAD e-schools initiative.

### 6.2.9 Ownership

The study found that lack of ownership was hindrance to the effective use of ICT in case study NEPAD e-schools. Although Rwanda ICT in education policy supports the idea of having a holistic ownership and sustainability of ICT in education initiatives and puts much emphasis on stakeholder ownership at all levels (MINEDUC, 2009). Ministry of education claim no capacity to support schools in terms of budget and day to day technical support, case study schools on the other hand claim having no funds for maintenance and sustainability of ICTs in schools, you find that there is a gap in the ownership of the project and this hinders the effective implementation of ICTs in those schools. Responsibility and ownership is important if effective implementation of ICT in schools is to happen.

## 6.3 Recommendations for policy and practice

The following recommendations for policy, practice made as a result of this study. These recommendations are relevant to the Ministry of Education of Rwanda, the Rwandan schools and the NEPAD e-Africa Commission. However the recommendations from this study can also be translated into other policy related implementation conditions.

### 6.3.1 Ministry of Education

**Policy alignment**

Ministry of Education should align ICT in education policy with other national education strategic and operational policies to ensure that ICT initiatives and programmes are in line with national developmental goals and objectives. For example, policies that emphasise the use of ICT for pedagogical reform should be aligned with teacher professional development

and ICT training that will provide the teacher with not only ICT skills but also pedagogical skills.

The study found that though Rwanda national ICT policy and ICT in education policy existed and well crafted, schools did not know about the policies and therefore the policies were not implemented at schools. Since schools are supposed to be the implementation agencies of these policies the researcher suggest that school principals and teachers be involved in the policy formulation otherwise the policies are just symbolic and therefore not realistic

**Partnerships in ICT implementation**

It is expensive for any country to introduce ICT in education system and make it effective, private public partnerships is an important resource in this regard, Ministry of Education should aim to build sustainable partnerships with private companies and NGOs, universities to offset expenses and alleviate the obstacles of the integration of ICT in education. Commitment and good will of partners is crucial for successful implementation of ICT in schools

**ICT advisory committee**

Ministry of Education should form a committee of experts to oversee the overall implementation of ICT in schools, this committee should among other things develop a plan for ICT implementation, develop a monitoring and evaluation plan for future improvement, advise on training needs of teachers and develop guidelines on how schools can manage ICTs in their respective schools.

**Financing mechanisms**

For any ICT in education initiative to be successful, sound financing mechanisms should be in place to cater for more hardware and software, teacher training and professional development, payment of monthly Internet fee and technical support and replacement of hardware and software. Ministry of Education should plan and avail the funds for the above if sustainability of ICT in schools is to be maintained

**Access**

The issue of lack of availability of Internet was found to be a barrier for both teachers and students for the use of ICT in schools; a recommendation is that Ministry of education should

negotiate for lower rates of Internet access for schools. The universal access fund should also be negotiated to cater for schools Internet access with particular attention to broadband.

**Capacity building**

The study found that Ministry of Education was understaffed in terms of ICT, for ICT in education initiatives to be effectively implemented; they need a pool of ICT in education experts. Training, maintenance, monitoring and evaluation also needs experts at the Ministry level to be able to continuously provide support to districts and schools in terms of building capacity

### 6.3.2 Schools

**School principal as agent of change**

School principal is an important agent of change in any school, when a new innovation is to be effective in any school, it needs a committed and skilled principal to drive it, for effective implementation and integration of ICT in schools a school principal and other school members of staff should be skilled in ICT, they should be aware of the importance of ICT in general and the importance of ICT in education in particular.

**ICT vision and policy**

Schools, with school principals playing a leading role should develop ICT vision, policy and technology plans that guide them where they are going, this vision and policy formulation should involve teachers, student representatives, parents and the community so that the vision, policy and plans are shared by all stakeholders.

**Training opportunities**

Schools, especially the school principals should provide professional ICT training opportunities to build teachers ability to fully utilise ICT opportunities in their teaching and learning practices. Teachers should continuously be given opportunities to update and upgrade their ICT skills and knowledge for their professional purposes. Schools should also train a critical mass of ICT champion teachers who support best practices in the integration of ICTs in schools.

**Knowledge sharing Platform**

Teachers need further support to have platforms where they can share knowledge, experiences and teaching materials with other teachers in other schools, this can be done on regional, national or international level. This can be facilitated by the school principal in collaboration with District education office and Ministry of Education.

**Adequate access and technical support**

Having adequate access to functioning ICT facilities by teachers is very important, therefore teachers need to be provided with adequate and on time technical support, if ICTs are to be used effectively in teaching and learning. Internet connectivity and accessibility is important in research and other education purposes, special consideration should be given to schools to have fast and reliable Internet connection and this will help teachers and students alike to get additional materials for their teaching and learning purposes.

**Time**

Another factor that favour effective use of ICTs in schools is time allowed for teachers, teachers should be allowed enough time to learn and develop new skills in ICTs, have additional time for lesson planning and time to integrate ICTs into their teaching and curriculum.

**Pre-service ICT training**

For teachers to be skilled and confident in integration of ICT in teaching, pre-service teacher training in ICT is necessary at universities and colleges before they graduate to become teachers. It is recommended that all those intending to become teachers should undergo pre-service ICT training at universities and colleges before they are certified to be teachers.

### 6.3.3 e-Africa Commission

To give recommendations for NEPAD e-Africa Commission on current implementation and integration of ICT in schools on sixteen pilot African countries and future roll out of e-schools in other countries, there is a need to consider that the sixteen countries differ in number of schools, size of school population and generally challenges they face differ as well.

**Develop explicit ICT policy and plan**

Drawing on lessons from the active e-schools progamme over the period 2005 to date. The NEPAD e-Africa Commission should develop policy and implementation plans for national governments and e-schools to follow. Such policy guidelines should relate both to national ICT policies, as well as to ICT in education policies. The study of three NEPAD e-schools in Rwanda highlights a few aspects of the lessons for policy and practice. Section 6.2 highlighted issues that need to be addressed.

**Lessons from other similar programmes**

There should be ongoing research programme on developments and challenges in NEPAD e-schools and other ICT in education programmes and those lessons should be used to form future plans for NEPAD e-schools.

**Sharing implementation opportunities or challenges**

As part of proposed research programme; following monitoring and evaluation of the NEPAD e-schools demonstration project, the NEPAD e-Africa Commission should share the different implementation opportunities or challenges to all NEPAD e-schools pilot countries and pilot schools so that countries/schools can learn from each other's implementation experiences.

## 6.4 Recommendations for further research

The focus of this study has been assessing whether NEPAD e-schools in Rwanda have achieved the initial aims and objectives. Investigating the success or failure of a project is critical and results from this study can provide lessons for the government and case study schools to improve the existing policy on ICTs in schools or it can be a starting point for schools to develop a vision and policies regarding the use of ICTs for teaching and learning.

The scope and the population of the study were very limited and this calls for more research to cover all six NEPAD e-schools. The involvement of all six NEPAD e-schools, the use of multi methods of data collection both quantitative and qualitative would also be important for the argument of validity and reliability in future study.

It was found in the study that lack of teacher ICT skills, was a barrier, further research on the role of professional teacher training in the implementation of ICT in schools is necessary.

The role of school principal is crucial in any new innovation at any school; therefore there is need for research on the role of school principal in the implementation of ICT policy in education.

Further research on the comparison in teaching and learning between NEPAD and non-NEPAD e-schools could also provide a good assessment and improvement of the existing policy on ICT in schools in Rwanda and other African countries in general.

Cost are crucial for policy making and insights therefore TCO/Cost benefit analysis as a guiding tool for the implementation and sustainability of NEPAD e-schools should be studied.

### 6.5 Conclusion

This study concludes that the NEPAD e-schools programme has not been implemented successfully in case study schools in Rwanda to achieve its desired outcomes of harnessing the potential of ICTs to improve, enrich and expand access to education. The NEPAD e-schools initiative has the potential to improve education if implemented well, however, means to achieve implementation goals seem to be unrealistic and the project cannot achieve those goals in isolation. The project can only succeed if it is implemented as a complement within a framework of other ICT in education policy and practices that are already in place in African governments.

The investment on NEPAD e-schools project is too high; it is very difficult for the poor African governments to sustain the effective use of technology in African schools alone, so partnerships (Public Private Partnerships) are crucial to complement the funding and implementation of ICT in education projects. The success or failure of the NEPAD e-schools therefore depend on collaborative partnerships, good political will and support of Africa countries. The partnerships, good political will and support will ensure sustainability of this new innovation in education delivery and add value to education in African schools system.

The study found that NEPAD e-schools programme has made all the efforts to introduce ICT in African schools to improve and enhance education but many barriers have been found to hinder the implementation of the project, lack of policy alignment, lack of ownership, insufficient funding, for more access to ICTs and connectivity, teacher training and professional development and technical support. Other issues found were related to teacher

attitudes and skills and time for use of ICT. For future roll out of NEPAD e-schools programme in other schools the above barriers should be considered, otherwise the programme may not be sustained.

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## APPENDICES

## APPENDIX A:

## INTERVIEW PROTOCOL FOR NEPAD E-SCHOOLS

### A1. Interview questions: Country liaison person for NEPAD e-schools

**Contact details of the respondent**

1. Does your country currently have a national policy for information communication technology (ICT)? Does the national ICT policy contain a sector policy on education?
2. Does the country's education policy have a focus on ICT in schools?
3. Is there a monitoring and evaluation mechanism with respect to education policy implementation? Please explain briefly.
4. Does the country have a structure responsible for coordinating the implementation of ICT in schools? If there are no separate bodies, how is implementation of ICT in schools coordinated, monitored and evaluated?
5. Is there a distinct budget for the introduction of ICT in schools?
6. What is the role of government in the implementation of ICTs in schools?
7. What roles are schools expected to play in the introduction of ICT for more effective teaching and learning?
8. For what purposes are teachers and schools participating in the NEPAD e-schools programme expected to utilise the computer laboratory? What do teachers and schools want the computer laboratory to offer to them?
9. Do you think schools have been adequately prepared to take on the responsibilities of effectively using ICTs for teaching and learning? Please comment.
10. Are there awareness programmes for schools with respect to utilising ICT in schools?
11. What are the barriers to the effective use of the NEPAD e-schools computer laboratory, if any?
12. How have other ICT in education initiatives in the school impacted the use of the NEPAD e-schools computer laboratory?
13. If you had the opportunity, what changes would you make to the NEPAD e-schools programme and the form of the computer laboratory? How would these changes benefit teachers and learners?

**Thank you very much for your cooperation**

**A2. Interview questions: School principals**

**Contact details of the respondent**

1. Does your school have an ICT policy in place? To what extent has this policy guided the implementation of the NEPAD e-schools programme and computer laboratory?
2. Is there a committee in place responsible for ICT in your school? What are their functions/roles? Who is represented on it?
3. In your view, are schools adequately prepared to take on the responsibilities associated with introducing ICT in schools for more effective teaching and learning?
4. Have you and other principals received training on using computers? If so, please briefly describe the training and its value to the NEPAD e-schools programme at your school.
5. How has the NEPAD e-schools computer laboratory changed the way teaching and learning takes place and is this a positive change?
6. How do the teachers integrate the resources available in the computer laboratory into the curriculum? Are there any drawbacks or advantages that occur as a result of the introduction of computers in teaching and learning?
7. What are your views on the role of teachers in utilizing the NEPAD e-schools programme to make further improvements in teaching and learning?
8. 
9. What benefits do teachers and the schools want the computer laboratory to offer to them?
10. Are there computer courses in place to upgrade teachers' skills in computer use? How does the maintenance of the NEPAD e-schools computers happen?
11. What kind of support does the school get from government, the private sector, parents or other partners in the implementation of e-schools process? What challenges does the school find in using the NEPAD e-schools computer lab?
12. If you had the opportunity, what changes would you make to the NEPAD e-schools programme and computer laboratory?

**Thank you very much for your cooperation**

**A3. Interview questions: ICT coordinator**

**Anonymous: school and qualification details of the respondent**

1. What were your expectations of the NEPAD e-schools computer laboratory in terms of making improvements to teaching and learning
2. What has your experience been of the NEPAD e-schools computer laboratory? What resources or benefits has it provided to teachers and students? How is the computer laboratory being used? Do all classes have access and how much time do they have in terms of the regular school timetable?
3. How is the NEPAD e-schools computer laboratory managed? Who are the role players that oversee its successful operation?
4. Does the NEPAD e-schools computer laboratory contain all the equipment that you need and is all equipment functioning well?
5. How do you maintain the computers – is there sufficient technical support from NEPAD, government or the private sector7. What challenges does the school meet in using NEPAD e-schools computer lab? What other support does the school need to use NEPAD e-schools computer laboratory more effectively for teaching and learning?

6. Does your school have a code of conduct for use of computers and Internet?
7. Do you have protocols in place to prevent children/adults from downloading 'unacceptable' material from the Internet?

8. If you had the opportunity, what changes would you make to the NEPAD e-schools programme and computer laboratory?

**Thank you very much for your cooperation**

**A4. Interview questions: Teachers**

**Anonymous: School, teaching grade and subject specialist details of the respondent**

1. How long have you been using computers to teach your subject?
2. How do you integrate computers and the Internet into teaching and learning for your students:
   - For lectures/presentations
   - For lesson preparation
   - For communicating with other students and teachers
   - For accessing and using online assessment tools
   - For preparing and collecting teaching and reference materials
   - For other reasons – briefly explain.
3. How much access do you have to computers and Internet at school? Do you use computers outside school hours?

4. What kind of or training do you receive support on the use of computers in your teaching activities?

5. Is computer access integrated into the school timetable? If so, how many students/classes have access to the computer lab and how much time per week?

6. What is your assessment of the value of the NEPAD e-schools computer laboratory? What do you think it should provide to you and other teachers and students? What would be the benefits to having computers in the classroom?

7. Have clear roles and responsibilities been given to teachers with respect to the NEPAD e-Schools programme?

8. As a teacher, what challenges do you or your school encounter in using the NEPAD e-schools computer lab? How do you think you/ the school can overcome these challenges?

9. If you had the opportunity, what changes would you make to the NEPAD e-schools programme and computer laboratory?

**Thank you very much for your cooperation**

**A5. Interview questions: Students**

**Anonymous: age and grade of student**

1. How many years have you been using computers? Who taught you how to use computers?
2. What are your favourite activities for using computers and how many hours per week are you able to use computers and related ICTs to do your studies?
3. Where else can you have access and use of these ICT tools and facilities outside of your normal school hours? Do you have access to the Internet?
4. How often do you use the Internet for surfing websites for educational purposes?
5. In your school, are you able to use the relevant ICT tools and facilities that you need in doing your schoolwork? What has your school done to help make use of computers possible? Do they need to do more?
6. In which classes or subjects do you use computers and related ICTs?
7. What computer applications do you use at school? Do computer technologies help you learn? If so, how?
8. Do you learn differently because of computers? Do teachers need to change the way they teach because of computers?
9. As a student what challenges do you or your school encounter in using NEPAD e-schools computer lab? How do you think you or the school can overcome these challenges?
10. What future support do you expect from teachers and the school administration as a whole?
11. If you had the opportunity, what changes would you make to the NEPAD e-schools programme and computer laboratory?

**Thank you very much for your cooperation**

**APPENDIX B:**

**Letter from Supervisor allowing me to collect data**




**Faculty of Commerce, Law and Management**
**University of the Witwatersrand, Johannesburg**
**PO Box 601**
**Wits 2050**

**Mobile : 082 569 7675**
**e-mail:**luciennesa@gmail.com**(mobile email) and**
lucienne.abrahams@wits.ac.za

25 February 2011

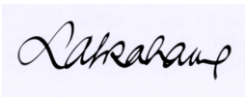
**To Whom It May Concern**

Dear Sir/Madam

**LETTER OF REQUEST: RESEARCH STUDIES MASTER OF MANAGEMENT (ICT POLICY AND REGULATION)**

Mr. Eugene Karangwa, Student Number 416611, is a student on the Masters of Management (ICT Policy and Regulation) degree programme. He is currently completing his research on the topic "Policy insights from an assessment of NEPAD e-schools in Rwanda". Please grant him an interview and an opportunity to gather data on the subject. The research conducted by students on the programme is very valuable to understanding the information society and its development and hence, to fostering such development.

With sincere appreciation,



Luci Abrahams, Degree Convenor: Masters of Management (ICT Policy and Regulation)

& Director LINK Centre, University of the Witwatersrand

# APPENDIX C

## Approval to conduct research in Rwanda

REPUBLIC OF RWANDA

Kigali, 18/03/2011

N°...../12.00/2011
648

MINISTRY OF EDUCATION
P.O.BOX 622 KIGALI

Mr. Karangwa Eugene
c/o University of Witwatersrand
Republic of South Africa
Johannesburg.
E-mail: karangwae@hotmail.com

RE: Approval to conduct research in Rwanda under the project title: 'Policy Insights from an Assessment of NEPAD e-schools in Rwanda'

Dear Mr. Karangwa,

With reference to your letter requesting for permission to conduct research in Rwanda, which was received on 14/03/2011, I am pleased to attach a copy of research clearance which has been granted to you to conduct research on the above project title.

I wish to remind you that the research permit number should be cited in your final research report, the research should be carried out under the affiliation of the Ministry of Education under the supervision of Solange Mutezintare, Director ICT in Education. Also a copy of the final research report is to be given to the Ministry of Education of Rwanda.

I wish you success in your research study.

Yours sincerely,

MINISTRY OF EDUCATION
GASINGIRWA Marie-Christine, PhD
Director General of Science,
Technology & Research

Dr. Marie Christine Gasingirwa
Director General Science, Technology and Research
Ministry of Education

cc.

- Minister of Education
- Minister of State in Charge of Primary and Secondary Education
- Permanent Secretary, Ministry of Education
- Advisor, Science and Technology, Ministry of Education
- Solange Mutezintare, Director, ICT in Education

# APPENDIX D

## A letter from Ministry of Education allowing to access schools

**REPUBLIC OF RWANDA**

**Kigali,** ..18/03/2011

**MINISTRY OF EDUCATION**
**P.O.BOX 622 KIGALI**

**Permission to Research in Rwanda**

**No: MINEDUC/S&T/0024/2011**

The Permission is hereby granted to Mr. Eugene Karangwa of University of Witwatersrand, South Africa to carry out a research on **'Policy Insights from an Assessment of NEPAD e-schools in Rwanda'.** The research will be carried out in Kigali and Gisenyi (St. Andre, Christ Roi , ESSA Gisenyi). Research will involve school principals, teachers, ICT coordinators and students.

The research will be carried out during the period between 21st March and 25th March 2011

The reference number of this letter shall be cited in the final research report as follows:

'Research conducted under permission No: MINEDUC/S&T/24/2011'

Pease allow Mr. Eugene Karangwa any help and support he might require to conduct this research

Yours sincerely

MINISTRY OF EDUCATION
GASINGIRWA Marie-Christine, PhD
Director General of Science, Technology & Research

Dr. Marie Christine Gasingirwa
Director General Science Technology and Research
Ministry of Education

## APPENDIX E

## A letter from School principal A allowing to access schools

**RE: ACCEPTANCE TO CONDUCT YOUR RESEARCH**

Dear, Eugene KARANGWA,

This is to inform you that you have been accepted to conduct your research at College Christ Roi as you earlier requested. You are permitted to administer your interview to school principal, a sample of teachers and students at this school.

The recommendations from your research report should be shared with the school so that they can improve on the integration and use of computers into teaching and learning.

Yours Sincerely

**Headmaster College Christ Roi**
**Nyanza**



Father Lambert KALINIJABO

## APPENDIX F

### Aletter from school principal B allowing me to access the school

**RE: ACCEPTANCE TO CONDUCT YOUR RESEARCH**

Dear, Eugene KARANGWA,

This is to inform you that you have been accepted to conduct your research at ESSA Gisenyi as you earlier requested. You are permitted to administer your interview to school principal, a sample of teachers and students at this school.

The recommendations from your research report should be shared with the school so that they can improve on the integration and use of computers into teaching and learning.

Yours Sincerely

SEBAGANWA M. Damien

**Headmaster ESSA Gisenyi**
**Rubavu**

## APPENDIX G

## Aletter from school principal B allowing me to access the school

RE: ACCEPTANCE TO CONDUCT YOUR RESEARCH

Dear, Eugene KARANGWA.

This is to inform you that you have been accepted to conduct your research at Lycee de kigali you earlier requested.You are permitted to administer your research questionnaires to teachers at this school

The recommendations from your research report should be shared with the school so that they can improve on their Computer usage

Yours Sincerely

Headmaster St. Andre Kigali
Kigali

## APPENDIX H

**Consent letters the interviews for CLP, School Principals, ICT coordinators, Teachers and Students**

University of the WITWATERSRAND

**Faculty of** Commerce, Law and Management

**Private Bag 3,** WITS**, 2050**

**Republic of South Africa**

February 2011

### CONSENT LETTER FOR INTERVIEW

Dear,

I hereby confirm that I have been informed by the researcher, Mr Eugene KARANGWA, about the nature of his study on "Policy Insights from Assessment of NEPAD e-schools in Rwanda".

The research aims to assess how the Rwanda NEPAD e-schools project is achieving its purpose. This will enable an analysis of the success and barriers to the effective utilization and integration of ICTs in Rwanda's NEPAD e-schools and investigate successes and failures of e-schools and lessons for Rwanda education policy.

I may, at any time, without prejudice, withdraw my consent and participation from this study and have had sufficient opportunity to ask questions/explanations during the interview with the researcher and declare that I am participating voluntarily in this study.

I have received, read and understood the information provided by the researcher regarding this study. I am aware that all the information I give will be treated confidentially and processed anonymously in this study and its final report. I also understand that the data collected for this study will be destroyed by the researcher once the study is completed. I hereby give consent with the understanding that strict confidentiality will be observed and assured.

Being interviewed

Yes ☐ No ☐

Tick the appropriate box

…… …… ……..

Signature (initials) Date Place