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## **EXTENT OF TEACHER PREPAREDNESS AND CAPACITY TO IMPLEMENT INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE NEPAD E-SCHOOLS, KENYA**

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## EXTENT OF TEACHER PREPAREDNESS AND CAPACITY TO IMPLEMENT INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE NEPAD E- SCHOOLS, KENYA

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### Abstract

**Purpose:** The purpose of this study was to determine the extent to which teachers and principals are prepared and capacitated to implement ICTs in the NEPAD e-Schools, Kenya.

**Methodology:** This study adopted a descriptive survey design. Both quantitative and qualitative data were collected. The target population for the study were all principals and 256 teachers from 6 model e-Schools. Sampling was done employing a mixture of methods. Stratified sampling was used to pick schools, while purposive sampling was used to pick principals and teachers. Five principals and 110 teachers were sampled. Data was collected using questionnaire for teachers, and structured interview for principals. The collected data was coded, run for descriptive analysis; including frequencies, percentages, measures of central tendency and measures of variability/spread, and presented with the aid of appropriate notes, frequency tables, percentages, charts and figures.

**Findings:** The study established that despite most teachers and principals having been trained, they had not been sufficiently empowered towards effectively and successfully applying ICTs. Moreover, majority of the untrained teachers and principal had not trained because no training had occurred since they joined the schools. However, despite their status, most teachers believed they could still perform some tasks involving ICTs. Most trained teachers and principals needed to be trained, retrained and/or trained further on several skills, especially in the preparation and use of multimedia instructional tools, and on-line research and communication. The study concluded that most teachers and principals may be willing to apply ICTs but are limited by the nature and extent of their empowerment. Moreover, ICTs application programmes are likely to succeed better if they employ regular, on-going training.

**Unique contribution to theory, practice and policy:** The study could inform education planners and trainers about necessary adjustments to future pre-service and in-service teacher training programmes involving application of ICTs. It would also contribute to the body of knowledge in educational technology, which might inform theory and practice in ICTs integration. It could also inform the development of best practices in the application and integration of ICTs in instruction.

**Keywords:** *E-Schools, ICTs, Implementation, Preparedness, NEPAD.*

## **1.0 INTRODUCTION**

### **1.1 Background to the Study**

Information and Communication Technologies (ICTs) are technological tools, resources and systems used to communicate, and to access, create, disseminate, gather, store, manipulate and manage information (Blurton, 2002). They include computers, CD-ROMs, the Internet, broadcasting technologies (radio and television), and telephony. Since the 1990s these technologies have rapidly permeated into different sectors of society (education included) and can no longer be ignored (UNESCO, 2000). In education, ICTs enable users to gather, manage, manipulate, access, and share educational information in various forms (Chan, 2002).

In the year 2000, the international community, meeting at the World Education Forum in Dakar (Senegal), realized that many African and other Third World countries were lagging far much behind in their uptake of ICTs in all sectors and decided to address the problem. They, identified several ICTs uptake priority sectors, with education being among the leading. Being aware of the fiscal implication involved on African and other developing countries, the forum urged for a multi-sectorial, multi-agency approach to the lodging of ICTs in education; since education is intricate and multifaceted. The forum advised running of pilot projects to enable appropriate adjustments before moving to scale (UNESCO, 2000).

The United Nations General Assembly (UNGA) meeting held later that year furthered the Dakar drive via the United Nations (UN) Millennium Declaration to accelerate global development through eight Millennium Development Goals (MDGs) aimed to be realized by the year 2015. Two of the MDGs were directly linked to education with the UNGA reiterating that global development could only be realized across board; including the education sector; through a concerted effort of both public and private partnerships (UNGA, 2000). Subsequently, Africa started witnessing multi-sectorial, multi-agency initiatives towards digitalization and ICTs uptake. The New Partnership for Africa's Development (NEPAD) joint ICTs project is a classic example.

Spearheaded by the African Union (AU), in 2003, NEPAD prioritized human development especially in health, education, science and technology, and skills development and identified ICTs as a major tool for accelerating the desired change (UNESCO, 2005). The NEPAD e-Schools initiative was born as a priority continental undertaking to digitalize schools and equip African learners with skills that would enable them participate effectively in the global information society. The ultimate goal was to digitalize all public schools in Africa within ten years of its inception. The programme was launched in 2005 with an aim to cover all high schools within five years. Demonstrations were initiated over 12-18 months in ninety-six model schools across 16 African countries before being handed over to the respective states for full roll-out (NEPAD e-Africa Commission, 2007).

In Kenya, NEPAD equipped six model secondary schools between 2005 and 2006, (MoE Kenya, 2008). The programme came in handy as the government was formulating policies and strategies for ICTs in education, developing e-learning delivery systems, building capacity, and developing requisite infrastructure and institutional management systems (GoK, 2005). For instance, the Kenya Education Sector Support Programme (KESSP) of 2005-2010, aimed to ensure provision of adequate and quality educational facilities for teacher training,

in-service programmes to upgrade teachers' skills, and revision of teacher education curricular to include skills in ICTs (MoEST, 2005). The NEPAD e-Schools programme was to be emulated and replicated across the country after piloting and take-over by the government.

From inception, the programme was envisaged to be holistically executed including at least the components of infrastructure (computers, communications, networking, power, etc.), training for teachers, content and curriculum development, effort towards community involvement and buy-in, stake-holding and ownership of the process, organization and management of the project, partnership issues, and financial and sustainability issues among others (NEPAD e-Africa Commission, 2007). Part of the programme's initial objectives was to:

- a) Provide ICT skills and knowledge to learners that will enable them to function in the emerging Information Society and Knowledge Economy;
- b) Provide teachers with ICT skills to enable them to use ICTs as tools to enhance teaching and learning; and
- c) Provide school managers with ICT skills to facilitate efficient management and administration in schools.

Hence, after equipping the model schools with the requisite tools and infrastructure, the NEPAD secretariat armed the principal and several teachers per school with some basic skills in ICTs. The target was to gradually but ultimately equip all teachers in the model schools with the necessary skills as digitalization of instruction took root (MoE, Kenya; 2008). It was hoped that the initially selected teachers would cascade the training down their staff mates and, later, other new teachers joining the schools. This trend was envisaged to continue into the future across the country once the programme was fully implemented.

According to UNESCO (2008), a number teacher capacities and competencies are necessary for technology upgrade and ICTs adoption in schools by teachers. First, teachers should acquire basic digital literacy skills alongside ability to select and use appropriate off-the-self educational tutorials, games, drill-and-practice, and web content in computer laboratories or with limited classroom facilities to complement standard curriculum objectives, assessment approaches, unit plans, and didactic teaching methods. They should also be able to use ICT to manage classroom data and support their own professional development. Apart from that, they should improve their pedagogical practice by applying various technologies, tools, and e-content as part of whole class, group, and individual student activities. They should know where and when (and when not) to use the technology for classroom activities and presentations, for management tasks, and to acquire additional subject matter and pedagogical knowledge in support of their own professional growth. The teachers should also have knowledge in the use of computers along with productivity software; drill and practice, tutorial, and web content; and the use of networks for management purposes.

Indications on the ground, however, show that the roll-out, whether in its original or revised form, is yet to happen, despite several studies having rated it highly as a being good and likely to transform instruction in Kenya. For instance, studies done by Mugo (2007), Ogutu (2008), Ayere, Odera & Agak (2010), and Nyagowa, Ocholla & Mutula (2012), concluded that, despite the model schools facing challenges, the ICTs in the schools were enabling

quality educational processes and classroom interactions. The e-Schools were even reporting improved performance in national examinations, which was corroborated by data provided by MoE (2008). Yet, despite the e-Schools programme having stagnated, running late, or perhaps abandoned altogether, the ICTs initially provided and/or thereafter added continue to play an important role in education generally, and in the instructional processes in particular in the model schools. The schools would also be expected to be cascading the empowerment of teachers to dynamically prepare learners for the digital world. Hence, there was need to determine whether the empowerment was still going on, the extent to which it was occurring and its impact on the teachers and managers of the model schools. This, therefore, inspired the institution of this study to determine the extent to which teachers (and principals) are prepared and capacitated to implement ICTs in the NEPAD e-Schools, Kenya.

### **1.2 Statement of the Problem**

The NEPAD e-Schools initiative was seen as a major milestone towards transforming instruction in Kenya and Africa. Yet, the studies done by Mugo (2007), Ogutu (2008), Ayere, Odera & Agak (2010), and Nyagowa, Ocholla & Mutula (2012) among others, concluded that, the model schools were also facing several challenges; including ICTs to users ratios, frequent breakdowns, high maintenance costs, frequent power and internet connectivity interruptions, inadequate time support for teachers, lack of relevant e-Contents, and insufficient skills and competencies by teachers among others. These challenges would likely affect the adoption, implementation and sustenance of ICTs in the schools if not appropriately addressed.

One would, therefore, be interested in establishing how far the model schools had gone in addressing these challenges, as well as those that came after the piloting period. The pertinent question that one would also ask is; after the NEPAD-led piloting ended, what direction did the pilot schools take in terms of application and maintenance of ICTs, training of teachers, and management of the instructional processes among other issues? Is integration still going on in the schools as before? Are teachers still being empowered? If so, how is it taking place and to what extent? Since the NEPAD e-Schools initiative was of a kind, and considering that advances in ICTs are constantly being witnessed world over, there was need for a current study to determine the trajectory of digitalization and capacity building in the e-Schools.

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

The purpose of this study was to determine the extent to which teachers and principals are prepared and capacitated to implement ICTs in the NEPAD e-Schools, Kenya.

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

Specifically, the objectives that guided this study were to:

- a) Establish teachers' and principals' status and extent of training in ICTs;
- b) Determine teachers' and principals' skill levels and capacity to implement ICTs;
- c) Establish teachers' and principals' areas of need in terms of training and capacity building.

### **1.5 Theoretical Framework**

Two theories informed this study: Diffusion of Innovations (DOI) by E.M. Rogers (2003); and Technological, Pedagogical and Content Knowledge (TPACK) by Mishra & Koehler



(2006; 2008).

### **1.5.1 Diffusion of Innovations (DOI) Theory**

This theory explains how new ideas and innovations are introduced, communicated and adopted (or rejected). According to Rogers (2003), diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system. In this process, participants create and share information in order to reach a mutual understanding about a new idea; enabling them to converge (or diverge) subject to the meanings they ascribe to the information or to some related events. For instance, integration of ICTs in instruction needs to be communicated to teachers, learners, school managers and other players in the school system through training, sensitization and persuasion over time. This will enable them to appreciate the reasons for integrating ICTs, and also share their thoughts with other members so as to reach a mutual decision to apply or reject the ICTs.

The theory identifies the four main elements of the diffusion of an innovation as: the innovation itself, the communication channels involved, time factor, and the social system wherein the diffusion is occurring. Hence, the main elements of integration of ICTs are the ICTs themselves; the training, sensitization and persuasion approaches used; the time (duration) involved, and the school settings where the ICTs are to be integrated. Time is at the nerve of the diffusion process. It is involved through the innovation-decision process; the mental process through which an individual (or a decision-making unit) passes; from first knowledge of an idea, to forming an attitude toward the idea, to a decision to adopt or reject, to implementation, and to confirmation of this decision. As such, the time taken to train, sensitize and persuade teachers and other players in the integration process and, to avail the necessary ICTs, and the time accorded teachers and learners in the integration process itself is vital in shaping the integration process itself.

However, critics cite several limitations. They argue that diffusion of any idea or innovation is difficult to quantify because humans and human networks are complex. It is extremely difficult, if not impossible, to measure what exactly causes adoption of an innovation because there are many forces acting on an individual and his or her decision to adopt a new behavior or technology. Lyytinen & Damsgaard (2001) for example argue that the theory fails to recognize that technologies are not discrete packages; they do not diffuse in a homogenous and fixed social ether; the diffusion rate is not solely a function of push and pull forces; choices are not functions of available information, preference functions and adopter's properties; diffusion does not necessarily traverse through distinct stages, which exhibit no feedback; and, time scales are not necessarily short and the history of decisions is not unimportant. For that reason, diffusion theories can never account for all variables, and therefore might miss critical predictors of adoption.

### **1.5.2 Technological, Pedagogical and Content Knowledge (TPACK) Theory**

This theory highlights the necessary knowledge by teachers for a productive integration of technologies in teaching. According to Mishra and Koehler (2008), three elements constitute an effective integration of ICTs in teaching, namely; content, pedagogical, and technological knowledge. They argue that teachers' subject (content) knowledge and pedagogical skills are not mutually exclusive but rather interconnected. The two interact and interrelate, and overlap with technology to create three intersections: Technological Pedagogical Knowledge, Technological Content Knowledge, and Pedagogical Content Knowledge. Ultimately, the

three elements and intersections form a mutual convergence - the Technological, Pedagogical, and Content Knowledge (TPACK) of a teacher.

The import of TPACK is that even ICTs require thoughtful entwining of technology, pedagogy and content knowledge for a fruitful integration. Through TPACK, this study recognizes the complex interrelationship among the different elements, which are contextually bound for a successful integration of ICTs. A concurrent and proper alliance of these elements makes a big difference in realizing the goals of investing in educational ICTs. For instance, if teachers have the necessary knowledge and training, the school environment is favourable and adequate ICTs are availed, the integration of ICTs is enhanced.

## **2.0 LITERATURE REVIEW**

### **2.1 Factors Influencing Teachers' Implementation of ICTs**

There are several factors; some serving to boost, while others acting as inhibitors; in the implementation of ICTs in education. However, this section briefly explores only two that were deemed as most fundamental: teacher characteristics; and teachers' preparedness.

#### **2.1.1 Teacher Characteristics**

Teacher characteristics greatly influence any educational improvement or innovation efforts. Studies indicate that teachers' gender (or sex) can influence the adoption of a new idea, especially how teachers adopt and use ICTs (Vekiri & Chronaki, 2008; Becta, 2008; Afshari, Bakar, Luan, Samah, & Fooi, 2009). Teachers also tend to differ in terms of performance level, innovation capacity and characteristics due to differences in the quality of their educational training. Studies indicate that educational qualification (academic and professional) influences the adoption of a new idea (Schiller, 2003; Afshari et al., 2009). For teachers to productively integrate ICTs, they ought to be academically and professionally qualified to ensure that they know how to and the reasons for utilizing technologies in their teaching.

Teachers' age and professional experience have also been found to influence the adoption of an idea, with those with fewer years of experience being more likely to use ICTs in their classes than teachers with more years of experience. This has been attributed, partly, to the fact that new teachers have been exposed to ICTs during their training and therefore, have more pre-service experience using ICTs than their predecessors (Schiller, 2003; Afshari et al., 2009). Older teachers, having successfully established routines of work that meet their criteria of good teaching, hesitate to change, especially if they do not understand the rationale for change (Scott & Usher, 2010).

Teachers' experience with ICTs for educational purposes has also been cited as a factor that can influence their adoption (Schiller, 2003; Afshari et al., 2009). Experience may be looked at in terms of the length of time and the instances that teachers have interacted with ICTs, as well as the skills they have gained during the interactions. Time is an important element in the ICTs implementation process. This includes the length of time teachers take from first knowledge of ICTs through their integration, and the ICTs' rate of adoption (application) at a given time period among other issues (Rogers, 2003). Since studies have shown differences in ICTs access and use across teachers and learners at any time (Colley & Comber, 2003; Vekiri & Chronaki, 2008; Becta, 2008), this factor was also considered in this study.

### **2.1.2 Teachers' Preparedness to Apply ICTs**

Society has come to an age where competencies in the use of ICTs are rapidly becoming basic qualities of an educated person. Therefore, the education system and teachers in particular are, almost inevitably, being demanded to integrate ICTs into instruction in order to prepare learners for the job market and empower them to fit into different sectors of society (Bitter & Pierson, 2005). Yet, it has been noted that formal teaching in the classroom is still driven by traditional teaching practices. Teachers are still to a great extent helping students acquire information from textbooks and acting as the information giver because teachers fear taking risks (Lee, 2002).

Teachers fear taking risks because they feel ill-prepared. Teachers can only train learners on ICTs if they themselves are literate and use them for instruction (Steketee, 2006). However, assertions abound that teachers, especially in developing countries, are not sufficiently trained to fruitfully integrate ICTs. According to Farrell and Isaacs (2007), many African ICTs integration ventures focus more on developing operational skills than on integrating ICTs in pedagogical practice. Balanskat, Blamire & Kefala (2006) call this inappropriate training which does not help teachers to use ICTs in their classrooms and in preparing lessons. Most teachers also receive a one-time or 'one-off' training; instead of extensive, on-going exposure in ICTs; which may not be sufficient to enable them integrate ICTs appropriately (Lau & Sim, 2008 and Trucano, 2005). Therefore, teachers should engage in both initial and on-going training to enhance their integration skills (Lau & Sim, 2008; Boakye & Banini, 2008).

There is also need to reform the entire teacher education system instead of just trying to 're-equip' teachers with ICTs if they are to feel comfortable using ICTs, let alone integrating them successfully into their teaching. The traditional one-time teacher training workshops have not been seen as effective. Discrete, 'one-off' training events, are seen as less effective than on-going professional development activities (Boakye & Banini, 2008 and Trucano, 2005). According to Brinkerhoef (2006), studies have shown that quality professional training programs help teachers implement ICTs and transform their teaching. Lawless and Pellegrino (2007) stress that if training programs on application of ICTs are to be of high quality, the training period should last longer and teachers are regularly updated on new ICTs for instruction among other important activities.

Teachers also need to clearly know the value of ICTs and deliberately incorporate them into the instructional process (Venkatesh & Bala, 2008). They need to understand the real reasons and, subsequently, benefits of integrating ICTs into their teaching. There needs to be a problem which cannot be best solved by the traditional resources (Mishra & Koehler, 2006; Venkatesh & Davis, 2000), and teachers need to view ICTs as agreeing with their values and beliefs, being better than previous media that they had already accepted and adopted, and fitting into their current instructional needs.

Teachers must also believe that ICTs are easy to adopt and use before they can agree to use them. Some teachers need to see others adopting and using ICTs to be assured that they too can use them. The experiences of the earlier users will bear on those that are yet to try (Rogers, 2003). They need to be reassured that ICTs are working, easy to use and are yielding the expected results. They also need to be aware of and be prepared to deal with any possible negative outcomes expected from the use of the ICTs before they can try (Roblyer, 2003).



This will help them anticipate and/or minimize any potential setbacks or embarrassments that failure of some ICTs may portend.

Teachers agree to use ICTs due to the rapidly nascent assurance that modern technologies afford many avenues of improving instruction in the classroom (Bingimlas, 2009; Lefebvre, Deaudelin & Loïselle, 2006). ICTs in education are potentially influential in bringing about, hitherto, unseen changes in ways of teaching. They have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before (Bingimlas, 2009). However, this potential can only be realized if, when and depending on how teachers have been inducted and deliberately implement the ICTs in the instructional processes and school administration.

## **2.2 Review of Studies Done on the Kenyan NEPAD e-Schools and Identified Gaps**

Several studies have previously been done on the NEPAD e-Schools in Kenya, yielding varied results. For instance, Mugo (2007) investigated the integration of ICTs in the science subjects in one of the model schools. He observed that the ICTs were too few; the computers to students ratio being 1:25. The ICTs were being used mainly to teach Computer Studies and less as general instructional media. The ICTs were not easily accessible for general integration due to their location, and lacked software and policy guidelines tailor-made for the Kenyan curriculum. Most teachers lacked training or skills in the use of ICTs and, hence, rarely used them. Rapid technological changes, ICTs breakdowns, high maintenance costs, frequent power and internet connectivity interruptions, inadequate time support for teachers, lack of relevant e-Contents, and teachers' inadequate exposure to ICTs were some of the challenges facing teachers. However, the study covered only 7 teachers in only one school.

A study done by Ogutu (2008) revealed that both students and teachers had developed a positive attitude towards the use ICTs and related accessories in the instructional process, as reflected both by the frequency of use of the ICTs and the interest indicated by the respondents. The study also revealed that the NEPAD e-Schools using educational management software for various processes. However, the schools faced some notable challenges like lack of funding to support the purchase of the technology to improve access, lack of training among teachers to adopt ICTs as teaching tools and lack suitable e-content for various subjects.

In another study, Ayere, Odera & Agak (2010) compared the application of e-learning in NEPAD and non-NEPAD schools in Kenya and reported that e-learning improved significantly the teaching/learning outcomes in secondary schools. The use of ICTs to teach subjects other than Computer Studies was far more frequent in NEPAD schools than in non-NEPAD ones due to availability of internet and ICTs like LCD projectors, smart boards and e-libraries. As a result, integration in NEPAD schools was significantly different as compared to the non-NEPAD schools; all students from NEPAD schools had access to electronic materials for educational research compared to only 17% from the non-NEPAD schools; and only 53% of all students in the study schools used internet services, 90% of whom were from NEPAD schools. As a result, there was a significant difference in the way the NEPAD and non-NEPAD school students used the internet services and e-libraries in education research. All the NEPAD schools had access to the internet and averagely had at least 6 e-libraries per school as compared to only 3 in one non-NEPAD school. NEPAD schools did better than the

non-NEPAD schools in national examinations but this could not be attributed directly to e-learning.

In their study, Nyagowa, Ocholla & Mutula (2012; 2013) evaluated the success of the NEPAD pilot schools in Kenya. They established that all the six schools had the basic facilities and infrastructure required to integrate ICTs in instruction, and had internet access via satellite in computer laboratories where a variable number of computers were installed. Students and teachers were also trained in the use of ICTs and they were using them for teaching and learning. Students found learning with ICTs enjoyable, which seemed to improve their performances as confirmed by examinations results in four of the schools. Hence, the study concluded that the NEPAD e-Schools project in Kenya has considerable potential for success. The study recommended that the national government and other stakeholders should continue investing in the NEPAD e-Schools project and expand it to more schools in a phased approach since the costs of deploying e-Schools at national level are very high. Public and private sectors should also be invited to participate in the expansion of ICT infrastructure for a more rapid uptake of e-Schools. The government could also lay strategies to ensure that the desired skills are incorporated in teacher in-service training, or teacher education curricula apart from enticing teachers to attend trainings (Nyagowa, Ocholla & Mutula, 2012; 2013).

As seen in the reviewed studies, the NEPAD e-Schools programme in Kenya has been variously investigated and found to be good, and to be having considerable potential for success if invested in and expanded to more schools nationally. However, most of these studies were done during the piloting and early years of the project. Some of the studies were also limited in scope by targeting only certain subject areas, while others were interested in the potential of the success of the project. Others were comparing and contrasting the project schools with the ones outside the project in terms of resources, performance among others. Yet, with piloting having long ended, little has been done to establish how the schools are faring after piloting and this study sought to contribute therein.

### **3.0 RESEARCH METHODOLOGY**

This study adopted a descriptive survey design. Both quantitative and qualitative data were collected. The collected data generated statistical, as well as narrative description and interpretation of events, conditions, or situations as they are (Picciano, 2004). The target population for the study was the 6 model e-Schools, their 6 principals and 256 teachers. A mixture of methods was used to pick the desired samples for the study. Stratified sampling was used to sample schools, while purposive sampling was used to sample principals and teachers. Stratified sampling involves selecting samples from different sub-groups (strata) so that each sub-group is adequately represented (Wiersma & Jurs, 2005). Purposive sampling is selecting cases with the required information, experience or expertise, or the most desirable features with respect to the objectives of a study while random sampling is applying probability to pick a portion of cases because the whole population is eligible (Mugenda & Mugenda, 2013). The schools were grouped into three strata: boys' only (2 schools), girls' only (3 schools) and mixed boys and girls (1 school). All the three schools in the boys' only and mixed schools strata were purposively sampled, being the only ones in their strata. In the girls' only stratum, two schools were randomly selected; ensuring that all the sub-groups were represented in the study. All the 5 principals and form three subject teachers in the

sampled schools were purposively selected because they were deemed to be rich in the information needed by this study. Sampling means selecting a subset, part or section of the population which a research intends to generalize its findings (Wiersma & Jurs, 2005).

Data was collected using questionnaire for teachers, and structured interview for principals. Piloting was initially done to ascertain the ability of the instruments, and the generated items, to elicit the responses they were expected to elicit and to measure that which they were supposed to measure before the actual data collection. The pilot study was done in the only NEPAD e-School that had remained after the sampling process. The school was excluded from the actual study. The school's principal and 10 randomly selected form three teachers participated in the pilot study. Piloting enables the researcher to identify any problems of the instruments and correct or prepare for them accordingly, aids in the testing and confirmation of reliability of instruments and generated items, and also examines the research methodology using the planned data-gathering techniques in order to ascertain the adequacy of research design overall and the functionality of data-gathering techniques in particular (Murray & Lawrence, 2000). Validation of instruments was done to ascertain the degree to which they measured what they were supposed to measure (Wiersma & Jurs, 2005; Orodho, 2004; Hittleman & Simon, 2006). A panel of faculty in the School of Education, Kenyatta University judged the instruments prior to piloting and their input were duly incorporated. Equivalent (parallel) forms reliability was used to test the instruments. Using Cronbach's alpha, the instruments' reliability was accepted at a coefficient score of  $r = .75$ .

The collected data was first cleaned and reduced before coding. The Statistical Product and Service Solutions or SPSS (formerly Statistical Package for the Social Sciences) version 22.0 was used to analyze the data. The quantitative data mainly generated by the close-ended items in the teachers' questionnaire; was coded and keyed into the computer. The qualitative data, mainly generated by the principals' interview schedule was analysed by first establishing their categories and by establishing their themes. The data was then coded, and keyed into the computer. All the coded data were thereafter run for descriptive analysis, which included frequencies, percentages, measures of central tendency and measures of variability/spread. Finally, all the analysed data were presented with the aid of appropriate notes, frequency tables, percentages, charts and figures according to the objectives of the study.

## **4.0 PRESENTATION, INTERPRETATION AND DISCUSSION OF FINDINGS**

### **4.1 Instruments Return Rate**

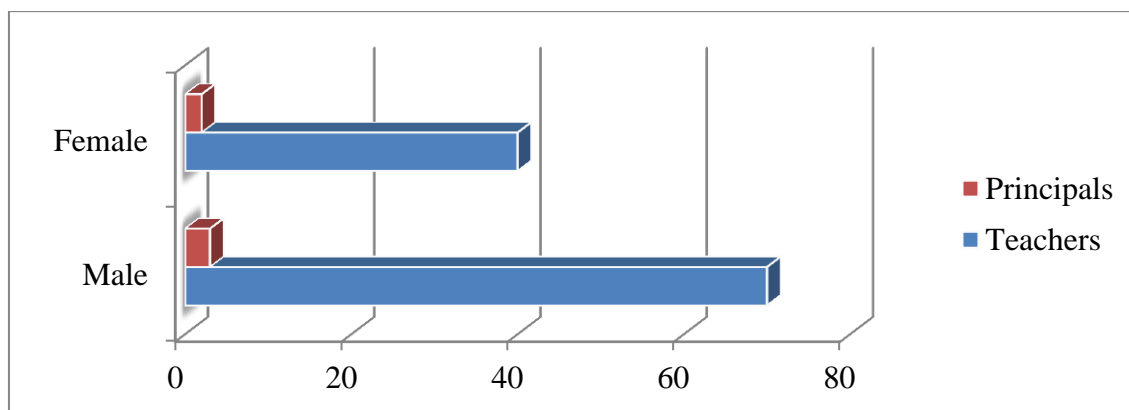
The teachers' questionnaire was administered to and returned by all the sampled 110 teachers who were teaching at least one subject in the form three classes of their schools. The principals' questionnaire was administered on 5 principals. All (100%) of them returned their instruments.

### **4.2 Demographic Data of the Study Subjects**

The demographic data that was sought included gender, academic and professional qualification, age and working experience, length of stay in their present schools, length of teaching/working under the e-schools programme. This data was important when analyzing the rest of the findings of the study based on the objectives of the study.

#### **4.2.1 Respondents' Gender**

Gender is the status of being identified as being either male or female. This study first sought to establish the teachers' and principals' gender. Figure 1 summarizes the generated information.



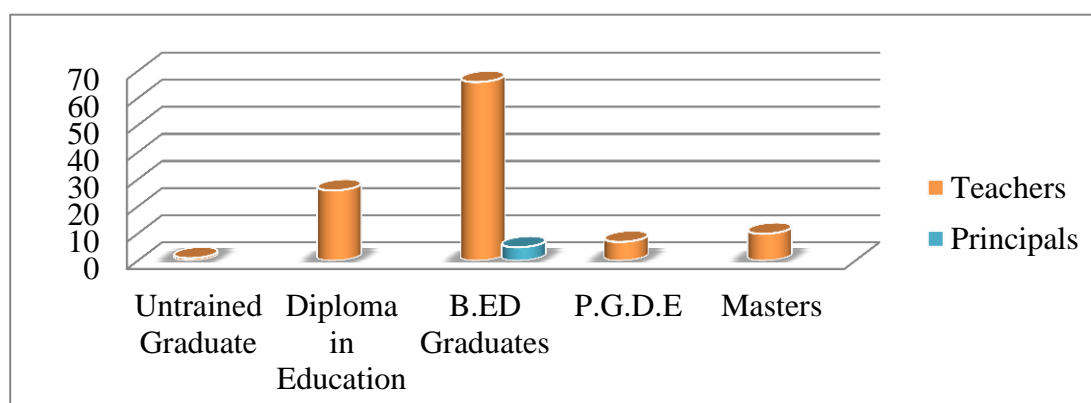
**Teachers (N = 110); Principals (N = 5)**

**Figure 1: Distribution of Teachers and Principals**

Figure 1 reveals that 70 (63.6%) teachers and 3 (60%) principals were males, while 40 (36.4%) teachers and 2 (40%) principals were females respectively. Therefore, we may conclude that most of the teachers and principals in the e-Schools under study were male. This implies that the teaching profession is still male dominated and calls for players in the education sector to address this disparity especially through teacher training affirmative action.

#### 4.2.2 Respondents' Academic and Professional Qualifications

This study also sought information about the teachers' and principals' academic and/or professional qualifications. This means the highest level of educational training that one obtained in relation to his/her qualification as a teacher. Figure 2 is a summary of their qualifications.



**Teachers (N = 110); Principals (N = 5)**

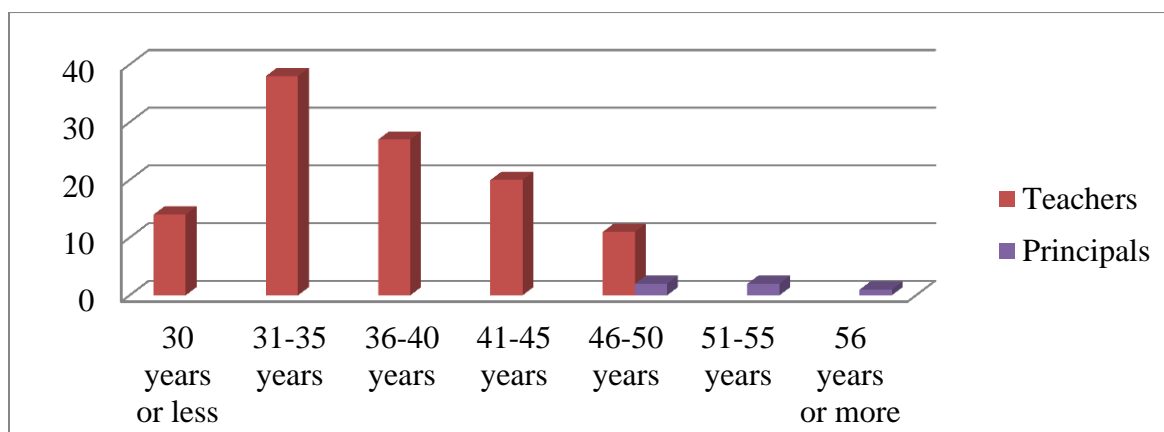
**Figure 2: Teachers' and Principals' Academic/Professional Qualifications**

Figure 2 reveals that all 5 (100%) principals and 66 (60.0%) teachers were Bachelor of Education (B.ED) degree graduates. Twenty six (23.6%) teachers were Diploma in Education

holders, 10 (9.1%) were Masters’ degree graduates (with B.ED as first degree), 7 (6.4%) Post Graduate Diploma in Education (P.G.D.E) holders and only 1 (0.9%) was an untrained graduate teacher. We can, therefore, conclude that 100% the principals and at least 99% of the teachers were professionally trained and qualified.

#### 4.2.3 Respondents’ Age Distribution and Working Experience

Teachers’ and principals’ demographic data also included their age distribution. Age is the number of years one has lived after birth. Figure 3 summarizes the generated data.

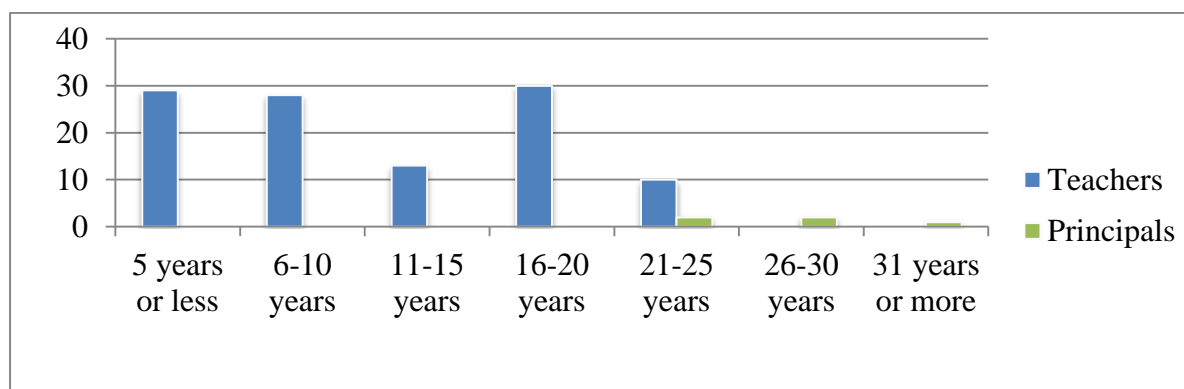


**Teachers (N = 110); Principals (N = 5)**

**Figure 3: Teachers’ and Principals’ Age Distribution**

Figure 3 reveals that 38 (34.5%) teachers were aged between 31 and 35 years, 27 (24.5%) were aged between 36 and 40 years, 20 (18.2%) were aged between 41 and 45 years, 14 (12.7%) were aged 30 years or below, and 11 (10.0%) were aged 46 years or more. On their part, 2 (40%) principals were aged between 46 and 50 years, another 2 (40%) were aged between 51 and 55 years, and 1 (20%) was aged 56 or more years. The teachers’ mean age was 37 years, while the principals’ mean age was 52 years.

The teachers and principals were also asked about their working experience - the number of years one had worked as a teacher. Figure 4 shows the findings.



**Teachers (N = 110); Principals (N = 5)**

**Figure 4: Teachers’ and Principals’ Working Experience**

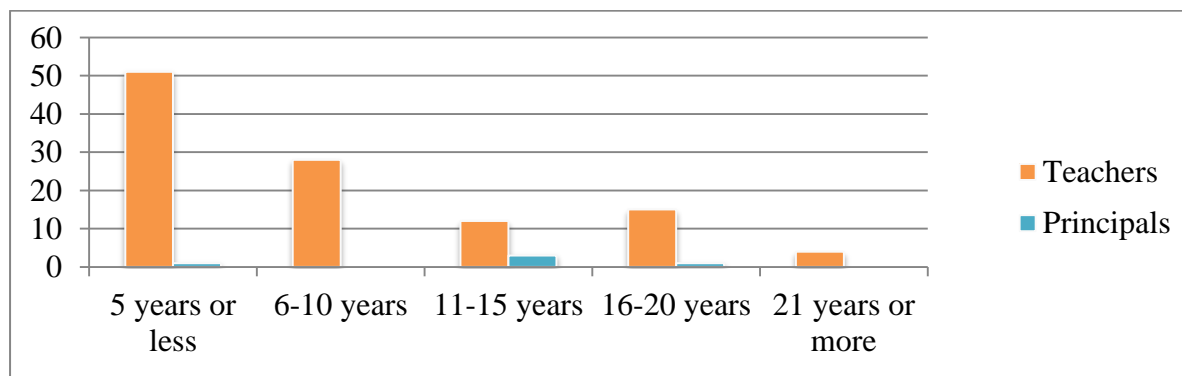


Figure 4 reveals that 30 (27.3%) teachers had a teaching experience of between 16 and 20 years, 29 (26.4%) had an experience of 5 years or less, 28 (25.5%) had an experience of between 6 and 10 years, 13 (11.8%) had an experience of between 11 and 15 years, while 10 (9.1) had an experience of 21 or more years. For the principals, 2 (40%) had a work experience of between 21 and 25 years, another 2 (40%) had an experience of between 26 and 30 years, while 1 (20%) had an experience of 31 years or more. The teachers' average working experience was 11 years, while that of the principals was 27 years.

It can, therefore, be established from Figure 3 and Figure 4 that most teachers (71.8%), were aged 40 years and below, with most of them (63.6%) having taught for 15 years or less. This group could be classified as young professionally since most of them still had more than half of their teaching years ahead of them considering that in Kenya, the current retirement age from formal employment is 60 years. Their teaching experience could be said to be relatively short, especially when compared with that of the 10 (9.1%) teachers who had a teaching experience of 21 years and above. Furthermore, it can also be realized that all the principals (100%) were aged 46 years and above, with most of them (60%) being aged at least 51 years. Moreover, all the principals (100%) had worked for more than 21 years, most of them (60%) having worked for at least 26 years.

#### 4.2.4 Respondents' length of stay in their present schools

This study also sought to establish the teachers' and principals' length of stay (in years) in their present schools and under the e-schools programme. Figure 5 shows of the respondents' length of stay in their current schools.



**Teachers (N = 110); Principals (N = 5)**

#### Figure 5: Teachers' and Principals' Length of Stay in Current Schools

Figure 5 shows that 51 (46.4%) teachers had been teaching in their current schools for 5 years or less, 28 (25.5%) for between 6 and 10 years, 15 (13.6%) for between 16 and 20 years, 12 (10.9%) for between 11 and 15 years, and 4 (3.6%) for 21 years or more. For the principals, 3 (60%) had been working in their current schools for between 11 and 15 years, 1 (20%) for between 16 and 20 years, and 1 (20%) for 5 years or less. The teachers' mean length of working in their present stations was 8 years, while the principals' was 12 years (with 4 (80%) having been there for more than 11 years).

It can, therefore, be concluded that, by the time of this study, most teachers - 59 (53.6%) - and principals - 4 (80%) - had been working in their present schools for more than 6 years. Hence, they were either already working in the schools (some of them for long) before the

introduction of the e-Schools programme, during piloting, or shortly after the piloting period. This would lead one to expect that these teachers and principals had been inducted in the use of ICTs - and were therefore probably more prepared and experienced using them - better than the teachers and principal who had taught in the e-Schools for 5 years or less.

It has been observed that teacher characteristics are important in any educational improvement or innovation (Fullan, 2001; Tang & Ang, 2002). For instance, teachers' sex (or gender) can influence the adoption of a new idea (Rogers, 2003; Afshari et al., 2009). Differences in academic and professional qualifications can also contribute towards teachers' tendencies to differ in performance level, innovation, capacity and affinity to change (Schiller, 2003; Afshari et al., 2009). For teachers to productively integrate ICTs, they ought to be academically and professionally qualified to ensure that they know how to and the reasons for interweaving content, pedagogy and technology (Mishra & Koehler, 2008; 2006).

However, age and professional experience have also been found to influence the adoption of an innovation (Rogers, 2003; Schiller, 2003; Afshari et al., 2009). Younger and newer teachers are viewed as more likely to use ICTs in their classes than their older colleagues due to, partly, the fact that new teachers may have been exposed to ICTs during their pre-service training than their predecessors (Afshari et al., 2009). Moreover, younger people are more open to new ideas even if they do not have prior knowledge. Older teachers (and principals) on their part, having successfully established routines that meet their standards of quality, hesitate to change especially if they do not understand the basis for change (Scott & Usher, 2010).

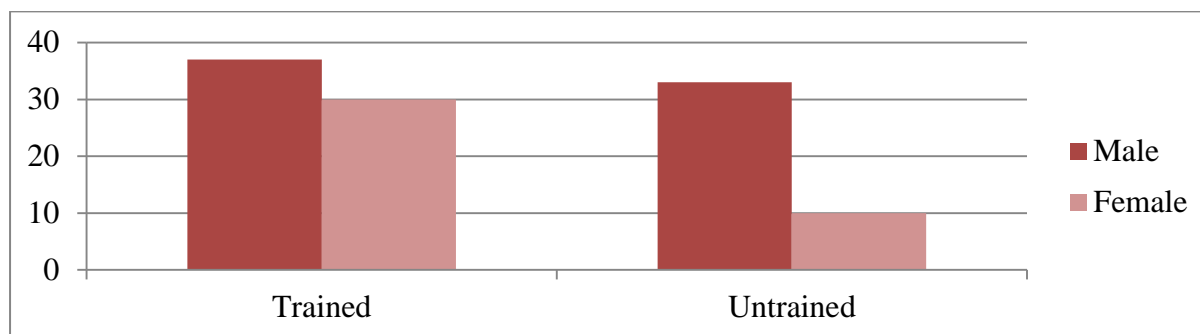
Yet, age and professional experience aside, the effect of teachers' on-job practical interactions with ICTs cannot be overlooked. The kind (quality) and length of teachers' experience with ICTs is a factor that can influence their adoption of ICTs for instructional use (Schiller, 2003; Afshari et al., 2009). Time is an important element in the ICTs adoption process. For instance, the length of time a teacher takes from their first experience with ICTs through their adoption or rejection - compared with other teachers in the system - and the ICTs' rate of adoption into education (the number of teachers adopting and integrating ICTs in a given time period) are among the issues that can determine the extent of integration of ICTs into instruction (Rogers, 2003).

### **4.3 Respondents' Status and Extent of Training in ICTs**

Objective one of this study was to establish teachers' and principals' status and extent of training in ICTs.

#### **4.3.1 Respondents' ICTs Training Status**

All the 110 teachers and 5 principals were asked if they had been trained or in-serviced on the use of the e-Schools ICTs. Sixty-seven (60.9%) teachers and 4 (80%) principals said they had been trained, while 43 (39.1%) teachers and 1 (20%) principal said they had not been trained. Figure 6 summarizes the teachers' training status by gender.



**N = 110**

**Figure 6: Teachers' training status by gender**

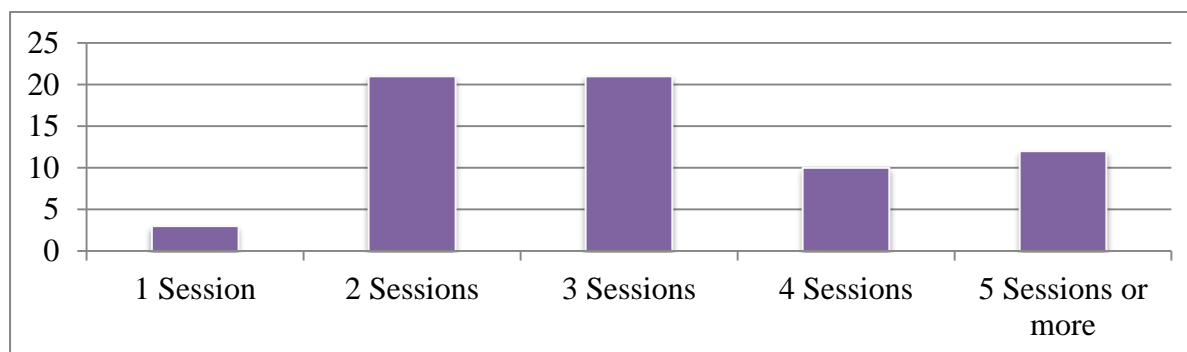
A cursory look at Figure 6 shows that 37 (55.2%) of the trained teachers were male and 30 (44.8%) were female. This would lead one to hastily conclude that, overall, more males than females were trained and, hence, support many studies that have indicated that more male teachers' are usually trained and, therefore, more influenced in the adoption of technologies than their female counterparts (Rogers, 2003; Schiller, 2003; Afshari et al., 2009). However, the findings of the current study show that the ratio of training per gender places female teachers ahead of their male counterparts. Thirty (75.0%) of the 40 female respondents had been trained, while 37 (52.9%) of their 70 male counterparts had been trained. The explanation for this scenario was that most of the teachers who had not been trained (33 out of 43 or 76.7%) were males, who had taught in the e-Schools for not more than 5 years. These teachers had either been freshly employed or had been transferred from schools outside the NEPAD programme. Therefore, the current findings contrast the assertions that the ratio of male teachers' that are usually trained in ICTs exceeds that of their female counterparts (Rogers, 2003; Schiller, 2003; Afshari et al., 2009).

The 43 teachers and one principal who had not been trained were asked to give reasons for their status. Thirty-nine (90.7%) of these teachers and the principal said no training had occurred since they joined the schools, while 4 (9.3%) said they had not been involved in the training sessions despite being in the schools during the training sessions. Therefore, the conclusion was that most of the untrained teachers joined their schools after the training sessions ended. Furthermore, what had been done in terms of length of training was what is termed as a 'one-off' training rather than extensive, on-going exposure to ICTs (Lau & Sim, 2008 and Trucano, 2005). This cannot sufficiently empower teachers towards efficient and successful integration ICTs.

Moreover, the trained teachers did not cascade skills down to their untrained colleagues. Scholars assert that teachers should engage in both initial and on-going training activities in ICTs to enhance their integration skills. Instead of engaging them in customary one-time training workshops and events, there should be on-going professional development and regular updates (Lau & Sim, 2008; Boakye & Banini, 2008 and Trucano, 2005). This is not only for quality professional training to help teachers implement ICTs and transform their teaching (Brinkerhoef, 2006; Lawless & Pellegrino, 2007), but also to give opportunities for late entrants and new teachers to be trained.

#### **4.3.2 Respondents' Extent of Training in ICTs**

The study then sought information from those who had been trained. They were asked how many training sessions they had attended (sessions were appointed weekends of the school term whereby a weekend signifies a session). Figure 7 below summarizes teachers' responses.



**N = 67**

**Figure 7: Number of training sessions attended by teachers**

Figure 7 shows that 21 (31.3%) teachers said 2 sessions, another 21 (31.3%) said 3 sessions, 12 (17.9%) said 5 or more sessions, 10 (15.0%) had attended 4 sessions, while 3 (4.5%) had attended only one session. The mean of the training sessions the 67 trained teachers had attended was 3 with a standard deviation of 1.169, Variance of 1.368 and Range of 4. For the principals, 2 (50%) had attended 2 sessions, 1 (25%) principal 3 sessions, while 1 (25%) had attended 4 sessions. The mean of the training sessions the 4 principals had attended was 3 with a standard deviation of .957, Variance of .917 and Range of 2. The study, therefore, concluded that the trained teachers and principals had attended only a few training sessions with majority (62.7%) of teachers attending 2 or 3 sessions and half of the principals attending 2 sessions.

The trained teachers and principals were then asked to outline the aspects of ICTs that the training sessions had covered. Table 1 below summarizes the teachers' responses.

**Table 1: Aspects Covered by Teachers' ICTs Training Sessions**

Aspect covered	f	%
Basic ICT skills, introduction to computing	55	82.1
ICTs integration in lesson preparation	34	50.8
Integration of ICTs in class instruction	62	92.5
Research using internet	50	74.6
Preparation, presentation using Ms PowerPoint	56	83.6
Teaching using DSTV; Multi-choice channels/programs	41	61.2
Ms Word/word processing	63	94.0
Ms Excel/spreadsheets	53	79.1
Ms Access/Databases	50	74.6
Use of Smart board	26	38.8
Internet; Communication; e-mails	54	80.6
Use of audio, audiovisual resources in teaching	24	35.8
Principles of e-learning, Learn-things & e-content	54	80.6
Legal & ethical issues in e-learning and ICTs use	18	26.9

**Multiple responses (N = 67)**

Most of the respondents identified several aspects, with 63 (94.0%) teachers saying they dealt with word processing skills, 62 (92.5%) covered the integration of ICTs in classroom instruction, and 56 (83.6%) covering PowerPoint preparation and presentation skills. Fifty-five (82.1%) said they were also taught basic ICT skills and introduction to computers, 54 (80.6%) covered basic information communication and e-mailing, another 54 (80.6%) covered the principles of e-learning, e-contents access and Learn-things and 53 (79.1%) covered spreadsheets preparation among others. Most teachers gave multiple responses.

The aspects covered by principals are summarized in Table 2 below.

**Table 2: Aspects Covered by the Principals' Training Sessions**

Aspect covered	f	%
Basic ICT skills, introduction to computing	3	75.0
Preparation, presentation using Ms PowerPoint	2	50.0
Ms Word/word processing	4	100.0
Ms Excel/spreadsheets	3	75.0
Ms Access/Databases	2	50.0
Internet; Communication; e-mails	2	50.0

#### Multiple responses (N = 4)

All 4 (100%) principals were trained in word processing skills, 3 (75%) covered basic ICT skills and introduction to computers, while 3 (75%) were trained how to prepare spreadsheets. Two (50%) were taught basic information communication, internet use and e-mailing, another 2 (50%) were taught how to create and manage Databases, while another 2 (50%) were taught how to prepare and present PowerPoint slides. Most of them gave multiple responses.

The trained teachers' and principals' were then asked if, in their opinion, they were sufficiently trained in the aspects that they covered. Fifty-four (80.6%) teachers said they were, while 13 (19.4%) and all the 4 (100%) principals said they were not. The respondents were asked to explain their answers. Fifty of the teachers who had said they were sufficiently trained responded as summarized in Table 3 below.

**Table 3: Skills Acquired by Teachers after Training**

Teachers' skill	f	%
Can use ICTs in class comfortably	20	40.0
Can use ICT labs efficiently	6	12.0
Skilled in computers and Ms Office tools	14	28.0
Increased confidence in using ICTs	10	20.0
<b>Total</b>	<b>50</b>	<b>100.0</b>

Twenty (40.0%) teachers could comfortably use ICTs in class, and 14 (28.0%) were now proficient in computers and use of different Microsoft Office applications. Ten (20.0%) were now more confident in using and interacting with ICTs, while 6 (12.0%) could now use and manage ICTs and computer labs more efficiently. On the other hand, 11 of the 13 teachers who had said that they were not sufficiently trained and all the 4 trained principals responded, where 6 (54.5%) teachers and 2 (50%) principals said the time taken for the training was too short to effectively cover the content being taught, while 5 (45.5%) teachers



and 2 (50%) principals said the number of sessions they attended were too few for them to master the skills being taught.

Hence, this study concluded that despite majority of the respondents under study having been trained in the use of ICTs, the 2 to 3 training sessions covered by most of them could not be said to have sufficiently empowered them towards efficiently and successfully using ICTs, or even integrating them in their teaching. Whatever the teachers attended in terms of sessions and/or length of training was what has been termed as a ‘one-off’ training in ICTs yet teachers require extensive, on-going exposure to ICTs to be able to evaluate and select the most appropriate resources (Lau & Sim, 2008 and Trucano, 2005). There is therefore need to reform teacher education/training instead of just trying to ‘re-equip’ them with ICTs if they are to feel comfortable using ICTs, let alone implementing them successfully into their teaching. The traditional one-time teacher training workshops have not been seen as effective. Discrete, ‘one-off’ training events, like those conducted on these respondents, are seen as less effective than on-going professional development (Lau & Sim, 2008; Boakye & Banini, 2008 and Trucano, 2005).

Studies reveal that quality professional training help teachers implement ICTs and transform their teaching (Brinkerhoef, 2006). Lawless and Pellegrino (2007) stress that if training programs on implementation of ICTs are to be of high quality, then the period of training should last longer and teachers regularly updated on new ICTs for teaching and learning among other important activities. Hence, ICTs integration training in Kenya should also take longer, be ongoing and regular if teachers have to develop the expected integration skills and competencies.

#### 4.4 Respondents’ Skill Levels and Capacity to Implement ICTs

Objective two of the study was to determine teachers’ and principals’ skill levels and capacity to implement ICTs.

##### 4.4.1 Trained Teachers’ and Principals’ Skill Levels and Capacity

The trained teachers and principals were asked to outline the tasks that they could now do as a result of their training. Table 4 below summarizes the teachers’ responses.

**Table 4: Tasks Teachers could Perform after Training**

Task	f	%
Prepare students’ exams, assessment tools	48	71.6
Prepare, present PowerPoint lessons	42	62.7
Prepare instructional notes, handouts	33	49.3
Students’ exams analysis and preparation of reports	43	64.2
Typesetting, printing of documents	53	79.1
Educational research; e-contents search; e-teaching etc.	31	46.3
Make, use projections, slide presentations, videos etc.	30	44.8
Use Smart board	25	37.3
Prepare, keep and manage students’ and/or staff records	38	56.7
Internet searches; social media; communication; e-mails etc.	39	58.2
Developing e-contents; digitalizing teaching	14	20.9
Guiding e-learning, e-content access by learners	23	34.3
Use ICTs for multimedia instruction	10	14.9

Multiple responses (N = 67)

Fifty-three teachers (79.1%) said they could now type and print documents, 48 (71.6%) could prepare different students' exams and assessment tools, 43 (64.2%) could analyze students' examination and academic performance using spreadsheets, and 42 (62.7%) could prepare and present PowerPoint slide lessons. Thirty-nine (58.2%) could now communicate with others especially through e-mail and social media, 38 (56.7%) could prepare, keep and manage students' data and records (via Ms Access), and 33 (49.3%) could prepare instructional notes and teacher-made handouts among other tasks. The respondents gave multiple responses.

The principals also outlined the tasks that they could now perform as a result of their training and Table 5 below summarizes their responses.

**Table 5: Tasks Principals could Perform after Training**

Task	f	%
Students' exams analysis and preparation of reports	3	75.0
Typesetting, printing of documents	4	100.0
Make, use projections, slide presentations, videos etc.	2	50.0
Prepare, keep and manage students' and/or staff records	3	75.0
Internet searches; social media; communication; e-mails etc.	2	50.0
Preparing and maintaining school financial records/accounts	3	75.0

#### **Multiple responses (N = 4)**

All 4 (100%) principals said they could type, process and print word documents, 3 (75%) could analyze students' examination results, prepare and process their reports, 3 (75%) could prepare, keep and manage students' and staff records, and another 3 (75%) could prepare and maintain their schools' financial records. Two (50%) principals could use the internet for information, research and communication purposes as well as e-mailing, while another 2 (50%) could prepare and use projections and PowerPoint presentations. The principals who responded gave multiple responses.

The trained respondents were then asked whether, in their opinion, the trainings had sufficiently prepared them to successfully use ICTs specifically in their teaching and/or administration. Forty-one (61.2%) teachers said it had, while 26 (38.8%) said it had not. The teachers were then asked to explain their answers. Of the 41 teachers who said it had, 36 responded, with 13 (36.1%) saying they had gained a strong background in computer skills and the use of different ICT tools, and another 13 (36.1%) saying they could now ably use ICTs in their teaching among other answers given. Of the 26 teachers who said it had not, 23 explained their answer where 8 (34.8%) said there was need for more training sessions and regular updates to keep teachers abreast with regular changes in ICTs, and 6 (26.1%) said whatever they had learnt was not enough to give them the confidence they needed in using ICTs. Five (21.7%) teachers said the scarce ICTs provided, as well as lack of internet connectivity, curtailed their mastery of the learnt skills, while 4 (17.4%) said their busy teaching schedules and high teaching workload hindered them from practicing and perfecting the skills they had been taught.

On their part, all the 4 (100%) trained principals said the trainings had not sufficiently prepared them to successfully use ICTs in their school duties. They were then asked to explain their answer. Two (50%) principals said they needed more training sessions and

regular updates to keep them abreast with regular changes in ICTs, and 2 (50%) said whatever they had learnt was too little to boost or affirm their confidence in using ICTs. Hence, contrary to the view held by the present study that the number of training sessions attended by most of the teachers under study were too few for them to master the skills being trained, and to sufficiently empower them to efficiently and successfully use ICTs and integrate them in classroom teaching, most of the trained teachers felt they had been sufficiently trained. These findings echo those by Lau & Sim (2008) that most teachers in Malaysian secondary schools considered themselves excellent or good in use of a number of ICT applications, even though most of them considered themselves as having limited training or knowledge to make full use of ICTs, or to even integrate them fully into teaching.

Unlike the trained teachers, however, the trained principals under study believed they were not sufficiently empowered towards efficiently and successfully using ICTs, or even implementing them in their administration. They had attended the ‘one-off’ training sessions in ICTs - alongside their teachers - instead of extensive, on-going training, and were therefore insufficiently empowered to efficiently and successfully use ICTs in their administrative and other school duties (Lau & Sim, 2008 and Trucano, 2005). Even though the trained principals could identify a number of skills they had acquired and the tasks they could now perform as a result of their training, they still felt that areas covered had not been sufficiently handled, hence, their desire for more training.

#### 4.4.2 Skill Status of Teachers and Principals without Training in ICTs

This study also sought to establish whether those teachers and principal who had not been trained in the use of the programme ICTs could still use them effectively in teaching and in other tasks. They were, therefore, asked if they could efficiently use the ICTs in their teaching and performing other tasks. All the 43 untrained teachers responded, where 21 (48.9%) of them said they could, 13 (30.2%) could not, while 9 (20.9%) were unsure. For the principal, she said she could not. The current study, therefore, established that, of the 43 untrained teachers, a majority (51.1%) either believed they could not, or were unsure if they could use the programme ICTs efficiently in teaching and performing other tasks. These findings concur with those by Lau & Sim (2008), which concluded that most untrained teachers in Malaysian secondary schools considered themselves as having limited knowledge to fully use ICTs, or to integrate them into teaching. The teachers and principal were, then, asked to outline the tasks they could perform despite their lack of training. Thirty-two teachers responded as presented in Table 6 below.

**Table 6: Tasks Teachers could Perform despite Lack of Training**

Tasks teachers can do	f	%
Exams/assessing students	19	59.4
Creating instructional presentations	22	68.8
Preparing instructional notes	14	43.8
Students' data analysis	16	50.0
Typing and printing of documents	21	65.6
Internet for research and e-teaching	11	34.4
Instructional video	2	6.3
Use of Smart board	3	9.4
None	2	6.3

**Multiple responses (N = 32)**

Most teachers believed they could perform several tasks with 22 (68.8%) saying they could create instructional presentations especially using Ms PowerPoint, 21 (65.6%) could type and print educational documents, 19 (59.4%) could create students' exams and assessment tools, and 16 (50.0%) could analyze and keep students' data among others. Two (6.3%) respondents, however, said they could not perform any task due to lack of basic ICT skills, speed and precision. Most respondents gave multiple responses. The principal, on her part, said she could not perform any task due to lack of basic ICT skills, speed and precision.

The level of confidence exuded by the teachers made this research to try and establish whether the confidence could be explained by the respondents' characteristics. This study concluded that the most probable explanation was that most of these teachers were young, aged 40 years and below, and having taught for 15 years or less (see Figure 3 and Figure 4). Teachers who are younger, and with fewer years of experience, are seen as more likely to try out using ICTs in their classes than the teachers with more years of experience. This is attributed, partly, to the fact that younger or newer teachers have been exposed to ICTs during their training and therefore, have more experience using them than their predecessors (Schiller, 2003; Afshari et al., 2009). These findings echo Lau & Sim's (2008) observation about teachers in Malaysian secondary schools that, even though most of them were untrained or considered themselves as having limited knowledge to fully use ICTs, or to integrate them fully into teaching, most of them still considered themselves excellent or good in use of a number of ICT applications. Nevertheless, ICTs implementation programmes should intensify regular, ongoing training sessions to ensure that some teachers are not left out and hence limited in their implementation of ICTs.

#### 4.5 Respondents' Training and Empowerment Needs

Objective three of the study was establish teachers' and principals' areas of need in terms of training and capacity building.

##### 4.5.1 Skills Identified by Teachers as Wanting

The trained teachers were asked to identify the areas that they felt they needed training and retraining or further training. They first listed the aspects that they had not yet been trained and felt they needed training. Table 7 summarizes their responses.

**Table 7: Aspects that ICTs Trained Teachers Needed Training in**

Aspect	f	%
Preparing multimedia instructional tools	32	47.8
Web design, scripting and programming	8	11.9
Instructional DSTV	7	10.5
PDF skills	5	7.5
Publishing	13	19.4
CD burning/writing	4	6.0
Classroom ICTs integration	25	37.3
Use of Projections	12	17.9
Selection of ICTs for instruction	20	29.9
ICTs maintenance, servicing etc.	28	41.8
PowerPoint skills	10	14.9
Software installation and ICT programming	16	23.9
None/ not sure	7	10.5

### Multiple responses (N = 67)

Thirty-two (47.8%) teachers needed skills on preparation of multimedia instructional tools, 28 (41.8%) on simple ICTs repair, maintenance and servicing skills, while 25 (37.3%) needed skills on different methods of integrating ICTs in the classroom. Twenty (29.9%) needed training on how to design instruction and select ICTs for instruction, 16 (23.9%) on simple software installation and ICT programming skills, while 13 (19.4%) needed training on publishing skills using Microsoft Publisher. Some respondents gave multiple responses.

The teachers then identified the areas that they felt they needed retraining or further training. Table 8 presents a summary of their responses.

**Table 8: Aspects that Teachers Needed Retraining or Further Training**

Aspect	f	%
Preparing multimedia instructional tools	30	44.8
Web design and programming	7	10.5
Internet/Web/Research	54	80.6
Database/Access	14	20.9
Publishing	4	6.0
Keyboard skills/Word processing/Typesetting	7	10.5
Classroom ICTs integration	20	29.9
Use of Projections	19	28.4
Exam administration and management with ICTs	3	4.5
ICTs maintenance, servicing etc.	14	20.9
PowerPoint skills	12	17.9
Drawing with ICTs	3	4.5
Recording class sessions	2	3.0
Smart-board use	5	7.5

### Multiple responses (N = 67)

Fifty-four (80.6%) teachers identified different aspects of Internet usage, Web browsing, online research and other uses of search engines, 30 (44.8%) identified preparation and use of multimedia instructional tools, and 20 (29.9%) identified classroom ICTs integration skills. Nineteen (28.4%) identified projection skills, 14 (20.9%) identified Database management skills (e.g Microsoft Access), another 14 (20.9%) identified ICTs hardware and software maintenance, servicing, programming etc. skills, while 12 (17.9%) identified creation and use of slide presentation (Microsoft PowerPoint) skills among others. Some respondents gave multiple responses.

Therefore, most of the trained teachers still desired to be trained, retrained or trained further in several skills. The findings of the study tend to aver with assertions by a number of scholars that teachers, especially in Africa and other developing countries, are not sufficiently trained to successfully integrate ICTs in their teaching. This, therefore, adds credence to the call that teachers be engaged in both initial and on-going training activities on how to use ICT to enhance their integration skills (Lau & Sim, 2008; Boakye & Banini, 2008 and Trucano, 2005). Engaging in on-going training activities will not only ensure that as many aspects of ICTs as possible are extensively handled, but that the aspects are taught intensely and trainees are refreshed regularly to enhance their ICTs use and integration skills. This could also help



lessen what Farrell and Isaacs (2007) term as a predominant focus of many African ICTs integration projects on developing ICT operational skills than on the integration of ICTs in pedagogical practice. This, as Balanskat et al. (2006) say, is inappropriate teacher training which does not help teachers to use ICTs in their classrooms and in preparing lessons.

The untrained teachers were finally asked whether they desired to be trained. Thirty (68.9%) teachers said they desired, 4 (9.3%) were unsure, while 9 (20.9%) did not respond. The teachers were asked to explain why they desired to be trained. Only 19 (44.2%) responded and said they needed to gain or enhance their basic skills in ICTs and be able to communicate, and use the ICT facilities effectively. The study, therefore concluded, that most of the untrained teachers desired to be trained in order to enhance their use of ICTs to communicate and teach. This adds credence to the need for ICTs integration programmes have regular, ongoing training sessions to ensure that newer teachers and late entrants into the programmes are not left out or disadvantaged.

#### 4.5.2 Skills Identified by Principals as Wanting

Thereafter, the trained principals identified the areas that they felt they needed training and retraining or further training in. The principals felt they needed training, retraining or further training as summarized in Table 9 below so as to make them better ICT users.

**Table 9: Aspects that Principals Needed Training, Retraining or Further Training**

Aspect	f	%
Internet use, Web browsing, online research and e-mailing	3	75.0
Word processing, Typesetting, printing and reprographic	3	75.0
PowerPoint preparation, presentation and other projection	2	50.0
Database management/Ms Access	2	50.0
Examination results analysis and management	2	50.0
Preparation and maintenance of school financial records; assets inventory	2	50.0

#### Multiple responses (N = 4)

Three (75%) principals identified Internet use, Web browsing, online research and e-mailing, and another 3 (75%) identified Word processing, Typesetting, printing and reprographic skills. Two (50%) identified PowerPoint preparation, presentation and other projection skills, 2 (50%) identified Database management skills (e.g. Microsoft Access), 2 (50%) identified examination results analysis and management skills, and another 2 (50%) identified preparation and maintenance of school financial records and assets inventory. The principals gave multiple responses to the item.

The above findings, therefore, reveal that all the principals, like most teachers, desired to be trained, retrained or trained further in a number of skills to enable them fruitfully apply ICTs. These trainings could take place well if principals - like teachers - were engaged in on-going training activities (Lau & Sim, 2008; Boakye & Banini, 2008 and Trucano, 2005). Hence, there is need to reform teacher education/training accordingly if education programmes involving the application of ICTs are to be more effective and able to transform the teaching-learning process (Brinkerhoef, 2006). Training periods should last longer and trainees be regularly updated on new ICTs for teaching and learning among other important activities (Lawless & Pellegrino, 2007).

Finally, the untrained principal was then asked whether she desired to be trained. The principal said she desired to. The principal was asked to explain why she so desired. The principal said she needed to gain or enhance her basic skills in ICTs and be able to communicate and manage the ICTs effectively. The above response led this study to draw the same conclusion as in the case of teachers' ICTs training status and skill levels; that what had been done in terms of length of training for the principals was what is termed as a 'one-off' training rather than extensive, on-going exposure to ICTs (Lau & Sim, 2008 and Trucano, 2005). This cannot sufficiently empower them as much as possible towards efficient and successful integration ICTs in their duties.

## **5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Summary of the Study Findings**

#### **5.1.1 Teachers' and Principals' ICTs Training Status**

The study established that majority of the teachers and principals in the NEPAD e-Schools had been trained in the use of the ICTs provided to their schools. Most of the trained teachers and principals were already teaching in their present schools when the NEPAD e-Schools programme was introduced, or joined the schools just about the time of piloting and, thereafter, continued teaching there.

#### **5.1.2 Skill Levels of ICTs Trained Teachers and Principals**

The study established that the NEPAD trained teachers and principals had attended between 1 and 5 training sessions, with a majority attending 2 or 3 sessions. During the few training sessions, teachers were taught several skills and competencies in the application of ICTs. Hence, the trained teachers and principals had not been sufficiently empowered towards effectively and successfully using ICTs, or even integrating them in their teaching, despite a majority of the trained teachers feeling that they had been sufficiently trained.

#### **5.1.3 Skill Status of Teachers and Principals without Training in ICTs**

The study established that majority of the untrained teachers and the untrained principal either believed they could not, or were unsure if they could use the programme ICTs efficiently. Most of the teachers, however, believed they could still perform some tasks. In spite of this, most of these teachers and the principal desired to be trained in the use of ICTs.

#### **5.1.4 Skills Identified by ICTs Trained Teachers and Principals as Wanting**

The study established that there were several skills and/or competencies that teachers and principals had not yet been trained in and felt they needed training. There were also aspects that teachers had been trained in yet they felt that they needed retraining or further training. Hence, most trained teachers still needed to be trained, retrained and/or trained further in several skills. Foremost among these skills that teachers needed training in was the preparation and use of multimedia instructional tools; while prominent in the list of the aspects that teachers needed retraining and/or further training in was Internet use, Web browsing and on-line research and communication. For the principals, the main areas of need included Internet use, Web browsing, online research and e-mailing; and Word processing, typesetting, printing and reprographic skills.

### **5.2 Conclusions and Implications of the Study Findings**

- a) Teachers in the NEPAD e-Schools have not been sufficiently trained in the use of the ICTs provided to their schools. The implication of this conclusion is that teachers may be willing to integrate ICTs in their teaching but their abilities and capabilities in the application of ICTs are limited largely due to the nature and extent of their training. The brief nature and extent of the NEPAD e-Schools training programme cannot sufficiently empower teachers towards efficient and successful integration ICTs in their teaching.
- b) Irrespective of teachers' training status in the use of ICTs, younger or newer teachers, with fewer years of experience, are more likely to try out using ICTs in their teaching than those with more years of experience. This is attributed partly to the fact that they are more flexible and ready to try out new ideas, whether or not they have been exposed to ICTs during their training. The implication of this conclusion is that programmes in the application of ICTs are likely to have greater success if they implement and sustain regular, on-going training sessions that even new teachers entering the teaching profession are likely to find, join and benefit from.

### 5.3 Recommendations

- i) Pre-service teacher education programmes should include ICTs integration skills as part of their core training components if teachers are to feel empowered and comfortable using ICTs in their teaching.
- ii) In-service training programmes on implementation of ICTs should last longer, be regular and be qualitative and sufficient if they are to be of high impact. This will not only enable teachers to be regularly updated on new ICTs, but also cater for newly transferred or posted teachers and school administrators without prior ICTs implementation skills.

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