INFORMATION COMMUNICATION TECHNOLOGY (ICT) AND THE TEACHING – LEARNING PROCESS

A SELECTION OF SIX SECONDARY SCHOOLS IN MBALE DISTRICT, UGANDA

A Thesis Dissertation

Presented to the School of

Postgraduate Studies and Research

Kampala International University

Kampala, Uganda

In Partial Fulfillment of the Requirements for the Degree

Master of Arts in Educational Management and Administration

By:

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September, 2011

DECLARATION A

"This Thesis is my original work and has not been presented for a Degree or any other academic award in any University or Institution of Learning".

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DECLARATION B

"I/We confirm that the work reported in this Thesis was carried out by the candidate under my/our supervision".

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Name and Signature of Supervisor

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Date

APPROVAL SHEET

This Thesis entitled "INFORMATION COMMUNICATION TECHNOLOGY AND THE TEACHING-LEARNING PROCESS" prepared and submitted by Sentalo Alex in partial fulfillment of the requirements for the degree of 'Master of Arts in Educational Management and Administration' has been examined and approved by the panel on oral examination with a grade of PASSED.

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DEDICATION

I dedicate this work to my family members: Wife Maria Kaire and children: Nakalema Esther, Egesa E, Egasa C, Odeke Kizito, Nabwire Maureen, Akayo Cecilia, Achola Joan.

ACKNOWLEDGEMENT

I would like to acknowledge the contributions from Prof. Fagbamiye E, Mr Kiwewa Emmanuel (my supervisor) and the entire team of academics who formed the panel that vetted the initial proposal and approach to this research. My gratitude too goes to the school administrators of Nkoma SS, Mbale SS, Mbale High School, Comprehensive High School, Oxford High School and Bugisu High School for their effort in mobilizing students, the ICT Equipment and Textbook resources.

ABSTRACT

Information Communication Technology (ICT) and the Teaching – Learning process, the topic of study, are bed partners requiring an extensive study, premised on three contexts: ICT as a pedagogical foundation, ICT as a learning environment and ICT as a paradigm shift. The drive towards greater use of technology in education is aimed at modernizing schools and equipping the learners of today with skills that will make them able to use such technology in the workplace once they leave school. Any change in the teaching pedagogy should be supplemented by process management and connected to a realistic vision. This means schools should experiment within given boundaries. The population that was used for study was that of senior two students and this provided the relative sample sizes. An hypothesis "there is no difference between ICT – Integrated methodology and the traditional handicraft approach" resulted in the use of the t-test. Comparisons of different groups yielded different results at given levels of significance. While other interventions have been known to have a higher effect size (Feedback 1.13, prior ability 1.04, instructional quality 1.00, direct instruction 0.82) than class environment (at 0.56) of which ICT is part, by and large ICT – integrated teaching and learning provides benefits that arise from its embodiment and inclusion of most of the high performances. There is a need to go beyond pure observations and evaluate more concretely school contexts, learning situations and teaching processes to show under which circumstances ICT based activities can enhance learning and improve skills. This requires some degree of qualitative interpretation, in order to evaluate the causes of impact which have been observed. While it is not possible, strictly speaking, to develop a framework for judging the impact on learning environments it may be possible to describe the ways in which ICT could be contributing to the development of constructivist learning environments.

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CHAPTER 1

THE PROBLEM AND ITS SCOPE

Background of the study

In many developing countries there are few primary or secondary schools with computers. In Uganda, IT education and training has not been formally introduced in primary and secondary schools. A significantly high percentage of the population, including students, has limited IT literacy and computer knowledge. The majority of the students enrolled into tertiary institutions may have little or no knowledge or experience with computers.

In contrast to the above, students in developed countries are introduced to computers at an early age at home or in primary schools, which accelerates the learning process. For example, in Finland, the largest part of its GNP is invested for the education system. Learning skills, literacy and attitude towards learning, all arguably important factors in achieving success in adopting IT, are well developed. Computers were introduced there into primary and secondary schools in 1980. In the United States, Canada, Australia, and in most of Europe, where computers were introduced to primary, secondary and tertiary institutions years ago, IT-based educational tools have been used significantly to support learning. When students reach university entry level, they have developed computer skills and are IT literate. Advancing ASEAN (Association of South-East Asian Nations) countries like Singapore place emphasis on IT literacy and education. Sinebare (1999) cites Singapore as one example of a Newly Industrialized Country (NIC), and differentiates NICs from laissez-faire developed countries. He maintains that IT applications in the latter have been *ad hoc* because there has been no formal IT or industry policy, and because no formal structure has been established to implement such a policy. Both computer education and computer studies curricula have been left to chance. Most students in Uganda are not introduced to computers until at tertiary education level. However, recently individual schools in Uganda are introducing and incorporating computers in the school curriculum. A study of the two schools – Nkoma High School and Mbale S. S , provided a deeper insight in the application of ICT-integrated teaching-learning methodologies.

Statement of the problem

Many trades have embraced technology to improve productivity. Banks are now networked and have employed computer technology in automated teller machines(ATMs) and electronic fund transfers (EFTs) . The transport industry has simplified bookings and flight scheduling while television programming has been made easier through provision of interactive screen menus. The teaching-learning process in Uganda has lagged behind modernity. The classroom situation of 50 years ago: the teacher, blackboard, desks, clock, chalk and some few charts is still the same today (in 2011). Schools that have computers have not significantly progressed beyond word processing, database applications and data storage. The challenge identified is that schools have not embraced ICT in the teaching – learning activities to the level expected.

Purpose of the Study

The purpose of this study is to develop insight on how best an ICT- integrated teaching/learning process can be carried out in the context of limited resources and large numbers of students. This situation is characteristic of schools in Mbale and many other districts in the country.

Research Objectives

The key objectives of this research were to:

- Assess teacher competencies in the application of ICT-integrated teaching methodology.
- Assess budgeting processes with a focus on ICT components.
- Determine the adequacy of ICT teaching-learning materials and equipment.
- Asses the level of usage of computers and other ICT resources.

Determine whether ICT-Integrated Teaching/learning methodology is superior to the traditional blackboard method.

Research Questions

The research addressed the following questions:

Are the teachers competent in the use of ICT in educational practice?
Do schools have the ICT components in their budget?
Are schools adequately equipped with ICT materials?
What is the level of usage of the available equipment?
Does the use of ICT in the teaching-learning process cause higher academic attainment than the traditional blackboard method?

Hypothesis

The hypothesis that was tested is " There is no difference between the traditional handicraft method and the ICT-integrated Teaching-Learning Approach". The causal relationship between attainment and the type of intervention was investigated.

Scope

This study was focused on six schools in Mbale district, Uganda, that mirrored what might be in other schools in the region and the country at large. Issues that were considered are: How competent are the teachers in applying ICT equipment in the teaching-learning process? Do the budgeting processes include educational productivity reflections on the use of ICT? How accessible are the available ICT tools? Are ICT – integrated approaches any superior to the traditional teaching methods? An attempt was made to confine the research to variables that increase access to and usage of modern technology in educational achievement. Attention was directed at how the development phase of the teaching-learning process can be improved using technology. The research did not cover ICT as an independent learning environment as suggested by Web 2.0 Tools. Rather, the research focused on ICT as an intervention, much like feedback, as a teaching aid, much like ordinary visual materials.

Significance of the Study

There is already an increasing acceptance of the need for lifelong learning as opposed to loyal, lifelong employment. The way of the future, is for more adults to retrain (retool).

A rapidly increasing knowledge base is forcing individuals and institutions to be versatile and adaptable. Educational institutions are being pressured to provide costly up-to-date facilities such as computers, and make modern technologies (such as website resources) readily available.

" In order to function in the new world economy, students and their teachers have to learn to navigate large amounts of information, to analyze and make decisions, and to master new knowledge and to accomplish complex tasks collaboratively. Overloaded with information, one key outcome of any learning experience should be for learners to critically challenge the material collected in order to decide whether it can be considered useful input in any educational activity. This is the basis for the construction of knowledge. The use of ICT as part of the learning process can be subdivided into three different forms: as object, aspect, or medium. "(Plomp, Brummelhuis, & Pelgrum, 1997).

A study of what is going on and recommendations for an improvement is crucial as school administrators, students, teachers, parents and the Ministry of Education and Sports (MOES) stand to learn and benefit from the findings. Neighboring schools might wish to apply the experience of Nkoma Secondary School and/ or Mbale Secondary School in this promising approach to the teaching-learning process.

Operational Definitions of Key Terms

Cyber Program – A program in the Ministry of Education and Sports (MoES), Uganda, where selected schools had been supported with ICT equipment.

e-Maturity – Stage of development in which one is competent in applying online and ICT resources.

Experimental Mortality – the loss of subjects (individuals) in the course of an experiment.

Degrees of freedom – is a value calculated from the sample sizes that enables one to locate critical values on the Student-t tables.

Effect size – a measure of the degree and quality of a learning outcome

ICT - Information Communication Technology- a term that describes the hardware equipment and software applications that act as an interface between the learner and the teacher.

Md – Mean deviation- the difference between a set of means from the overall mean.

Standard deviation – the computed variation of observed values from the sample mean.

Standard Error of the Mean – the error of the estimate of the population mean by the sample mean.

USE – Universal Secondary Education – Government sponsored secondary education in Uganda

Learning Outcomes - student achievements in a learning process

CHAPTER 2

REVIEW OF RELATED LITERATURE

Introduction

The review looks at the phases of the teaching – learning process, the teaching - learning principles and the knowledge sources in a learning environment. Theoretical aspects in each of the research questions raised in chapter one have also been addressed.

Concepts, Ideas and Opinions from authors/experts

The teaching-learning Process

According to Gita Hildar (2010) of the school of education, Pondicherry University, the teaching-learning process consists of three phases:

Phase 1: Preparation

In this stage, a teacher accomplishes the following.

A Scheme of work

A Lesson plan

Acquires/arranges Teaching-Learning Aids

Phase 2: Development

During lesson delivery, these activities take place:

Review of previously learnt knowledge/material

Subject Content Delivery

Interaction through the question-answer technique and demonstration

Methodology application – Demonstration, Illustration, Discussion and other methods

Phase 3: Evaluation

Oral Evaluation

Exercise /Assessment

Homework /Assignments

Information Communication Technology (ICT) components that are crucial in the Development and Evaluation phases of the Teaching-Learning process include:

Computers and printers.

Educational CDs, DVDs and Flash Disks (Virtual labs, Models, Language platforms, Demonstrations).

Internet Educational resources (Virtual realities, Simulations, Chat Rooms).

Custom Web-based Material (Virtual Map work, Uploaded teaching-learning Content, Past paper questions).

Projectors and a white screen.

The components mentioned are either storage, transmission or display devices and mechanisms. The research theory, which rhymes with Larry Cuban's (1986) modern philosophy of education therefore is that "technology will not have a significant impact on student learning until teachers change the way they teach".

Principles and Concepts of Teaching and Learning

According to the National Research Council (2000) and *Science for All Americans* (2010), the teaching and learning process has principles and concepts which include the following.

Learning Is Not Necessarily an Outcome of Teaching

Cognitive research is revealing that even with what is taken to be good instruction, many students, including academically talented ones, understand less than we think they do. With determination, students taking an examination are commonly able to identify what they have been told or what they have read; careful probing, however, often shows that their understanding is limited or distorted, if not altogether wrong. Schools should pick the most important concepts and skills to emphasize so that they can concentrate on the quality of understanding rather than on the quantity of information presented.

What Students Learn Is Influenced by Their Existing Ideas

People have to construct their own meaning regardless of how clearly teachers or books tell them things. Mostly, a person does this by connecting new information and concepts to what he or she already believes. Concepts—the essential units of human thought—that do not have multiple links with how a student thinks about the world are not likely to be remembered or useful. Or, if they do remain in memory, they will be tucked away in a drawer labeled, say, "biology course, 1995," and will not be available to affect thoughts about any other aspect of the world. Concepts are learned best when they are encountered in a variety of contexts and expressed in a variety of ways, for that ensures that there are more opportunities for them to become imbedded in a student's knowledge system.

Progression in Learning Is Usually From the Concrete to the Abstract

Young people can learn most readily about things that are tangible and directly accessible to their senses—visual, auditory, tactile, and kinesthetic. With experience, they grow in their ability to understand abstract concepts, manipulate symbols, reason logically, and generalize. These skills develop slowly, however, and the dependence of most people on concrete examples of new ideas persists throughout life. Concrete experiences are most effective in learning when they occur in the context of some relevant conceptual structure. The difficulties many students have in grasping abstractions are often masked by their ability to remember and recite technical terms that they do not understand. As a result, teachers—from kindergarten through college—

sometimes overestimate the ability of their students to handle abstractions, and they take the students' use of the right words as evidence of understanding.

People Learn to Do Well Only What They Practice Doing

If students are expected to apply ideas in novel situations, then they must practice applying them in novel situations. If they practice only calculating answers to predictable exercises or unrealistic "word problems," then that is all they are likely to learn. Similarly, students cannot learn to think critically, analyze information, communicate scientific ideas, make logical arguments, work as part of a team, and acquire other desirable skills unless they are permitted and encouraged to do those things over and over in many contexts.

Effective Learning by Students Requires Feedback

The mere repetition of tasks by students—whether manual or intellectual—is unlikely to lead to improved skills or keener insights. Learning often takes place best when students have opportunities to express ideas and get feedback from their peers. But for feedback to be most helpful to learners, it must consist of more than the provision of correct answers. Feedback ought to be analytical, to be suggestive, and to come at a time when students are interested in it. And then there must be time for students to reflect on the feedback they receive, to make adjustments and to try again—a requirement that is neglected, it is worth noting, by most examinations—especially finals.

Expectations Affect Performance

Students respond to their own expectations of what they can and cannot learn. If they believe they are able to learn something, whether solving equations or riding a bicycle, they usually make headway. But when they lack confidence, learning eludes them. Students grow in self-confidence as they experience success in learning, just as they lose confidence in the face of repeated failure. Thus, teachers need to provide students with challenging but attainable learning tasks and help them succeed.

What is more, students are quick to pick up the expectations of success or failure that others have for them. The positive and negative expectations shown by parents, counselors, principals, peers, and—more generally—by the news media affect students' expectations and hence their learning behavior. When, for instance, a teacher signals his or her lack of confidence in the ability of students to understand certain subjects, the students may lose confidence in their ability and may perform more poorly than they otherwise might. If this apparent failure reinforces the teacher's original judgment, a disheartening spiral of decreasing confidence and performance can result.

Teaching Should Be Consistent With the Nature of Scientific Inquiry

Science, mathematics, and technology are defined as much by what they do and how they do it as they are by the results they achieve. To understand them as ways of thinking and doing, as well as bodies of knowledge, requires that students have some experience with the kinds of thought and action that are typical of those fields

Sources of Knowledge

Pines and West (1986) developed what they called a "sources-of-knowledge" model of learning based on constructivism, which has been found most helpful. They discriminated between two sources of knowledge for school children: firstly, knowledge spontaneously acquired from interactions with the environment; and secondly, knowledge acquired formally through the intervention of school. These two sources of knowledge are represented as vines in a metaphor based on the writings of Vygotsky (1978). The former source originates from the learner and thus is known as the upward growing vine. The latter source is formal knowledge imposed on students and therefore is known as the downward growing vine. Therefore, education in schools is concerned with the meeting of these vines that Pines and West (1986) defined as four possible

Theoretical Perspectives

Teachers' Pedagogical Competence and Ongoing Professional Support.

Initial teacher training can take a variety of forms. Its duration, curriculum focus, teaching practice and other aspects differ strongly from country to country. There are two basic approaches or models in use (Victor 2010).

In the first, the training is pre-dominantly or entirely pre-career, and usually full-time and residential. This leaves few resources for ongoing professional development. In particular the crucial support of newly qualified teachers in their first years of teaching. Moreover, it often ignores long-term professional development, and teacher training institutions tend to be isolated from schools. In Uganda, the Centre Coordinating Tutor (CCT) model only stops at primary school level.

In the second approach , sometimes called school-based training, trainee teachers spend two-thirds of their time in schools. Such a model requires a sufficient number of schools with the capacity to coach and counsel trainees.

The curriculum of teacher training usually has four components: knowledge of the subjects that are to be taught, teaching methods, knowledge about how children learn and teaching practice. The time allocated to each varies considerably (Lewin,2004) and the importance of the first, subject knowledge, tends to be underestimated.

Educational policy has long put more priority on initial teacher training than on continuing, in-service education, although this balance is changing in some industrialized and developing countries.

Teacher professional development should have five foci: 1) skills with particular applications; 2) integration into existing curricula; 3) curricular changes related to the use of IT (including changes in instructional design); 4) changes in teacher role, and 5) underpinning educational theories. Ideally, these should be addressed in pre-service teacher training and built on and enhanced in-service. In some countries, like Singapore, Malaysia, and the United Kingdom, teaching accreditation requirements include training in ICT use. ICTs are swiftly evolving technologies and even the most

ICT fluent teachers need to continuously upgrade their skills and keep abreast of the latest developments and best practices. While the first focus—skills with particular applications—is self-evident, the four other foci are of equal, if not ultimately greater, importance. Research on the use of ICTs in different educational settings over the years invariably identify as a barrier to success the inability of teachers to understand why they should use ICTs and how exactly they can use ICTs to help them teach better. Unfortunately, most teacher professional development in ICTs are heavy on "teaching the tools" and light on "using the tools to teach."

Teacher anxiety over being replaced by technology or losing their authority in the classroom as the learning process becomes more learner-centered—an acknowledged barrier to ICT adoption—can be alleviated only if teachers have a keen understanding and appreciation of their changing role.

School Budgeting Components

According to Commonwealth of Australia (2010), annual expenditure on maintaining, replenishing and expanding school ICT infrastructure may amount to many hundreds of dollars per student. The costs of developing and maintaining a school's ICT infrastructure are significant.

ICT infrastructure costs include:

capital costs, including costs to acquire new hardware and software

recurrent costs, including costs for technical support, software licensing and telecommunications.

In some school systems and sectors, certain costs are managed outside the school through central budgets. The costs that are managed within schools are generally funded by:

general school operating grants from governments

parental contributions

funding associated with school building programs

reserve funds of the school

sponsorships.

The technical complexity of ICT infrastructure and the interconnectedness of many hundreds of components mean that a holistic approach is needed across all four infrastructure categories: access devices, network infrastructure, application software, and support resources.

Total cost of ownership

The total cost of ownership of a school's ICT infrastructure is the sum of all the costs associated with the acquisition, implementation and management of the various technology components (Commonwealth of Australia, 2010). Capital expenditure for new components such as computers is only one part of the total cost. New components also add to future recurrent costs because they increase the ongoing demand for:

technical support services

internal network infrastructure

telecommunications services.

Replacement costs also need to be considered because components have fixed lifetimes—desktop computers typically need to be replaced every four years, while network cabling will generally last 10 years or more.

Capital costs

According to Commonwealth Australia (2010), the capital cost items for enhancing ICT infrastructure and acquiring new components include the costs of:

hardware acquisition and replacement

software acquisition and replacement

new data cabling

changes to electrical wiring and equipment

environmental management equipment (including uninterruptible power supplies and air-conditioning units for server rooms)

consequential building changes, new furniture and fixtures

technical staff training associated with the purchase of new components

technical staff to design and install new components

disposal of redundant equipment by environmentally friendly means.

Recurrent costs

The recurrent cost items for ongoing management of the ICT infrastructure include the costs of (Commonwealth of Australia 2010):

hardware maintenance

software licensing

software maintenance

the replacement of obsolete hardware and software components

telecommunications

electricity

insurance

consumables, including paper and ink cartridges

the employment of technical staff

the training of technical staff (separate from the professional learning costs for teachers and school staff)

the engagement of suppliers of technical services.

Budgeting relates the expenditure of funds in a systematic manner to expected income. The school budget has several major functions.

It serves as a planning tool for the school and is prepared for a specific period of time, such as a term or year. The budget guides the carrying out of programmes during that time or period.

Budgets guide school managers and administrators. They provide for delegation of financial duties, since they indicate what activities are to be carried out with what amounts of money.

The budget can be used to evaluate school performance and school management.

There are two types of budget designs common in schools: the programme/performance budget and line item budget. The former states the income and expenditure and the objective to be achieved with each item of expenditure. The latter states the expected income and expenditure, but does not include what is to be achieved.

The school budget originates from school managers and administrators. A catalogue of differing interests, priorities and sources of funds play out to influence to a great deal the kind of outcome that is ultimately pronounced as the school budget.

Educational Productivity

Productivity is a concept most happily found in economics textbooks where the productivity of a worker or economic unit is defined by dividing the output (revenue) by the input (costs). This is more difficult to define for the education industry since the output is not easily measured, particularly not in monetary terms to compare with the costs. The output is largely the quantity and quality of learning demonstrated by students, or learning outcomes (as shown in the equation below).

$$\textbf{Productivity} = \frac{\text{Output}}{\text{Input}}$$

$$= \frac{\text{Educational Outcomes}}{\text{Costs}}$$

Where: Educational Outcomes = Quantity and quality of student learning.

Costs = Teacher and Student time, Classroom Materials, equipment, etc.

From the formula above it is clear that to increase productivity either the outputs must increase, the inputs decrease or both. There has been research conducted to attempt to estimate a numerical value for educational productivity. The best known work goes back to that by Niemiec, Sikorski and Walberg (1989) who calculated cost-effectiveness ratios. They found about a 30% average productivity improvement for examples involving computers compared with about 10% for peer tutoring. Unfortunately, educational productivity is difficult to calculate because it is difficult to estimate the value of educational outcomes. Even so it is useful to consider the concept of educational productivity, particularly the effect that educational technology may have. Educational technology should influence educational outcomes and costs. If the most appropriate educational technology is selected by a teacher then student learning should be optimized, which means an increase in the value of the outcomes. However, the use of some technologies is more expensive than others. ICTs tend to be relatively expensive to procure, install, maintain and support and this must be compared with the potential outcomes (Lankshear & Snyder, 2000). While it is important to consider educational productivity this should not be the only consideration in deciding to use a technology. There are situations where a certain technology should be used because it solves a major problem in teaching or learning (Lankshear & Snyder, 2000). This could in fact be seen as related to productivity, for if a part of the curriculum is not completed due to a lack of technology then the associated value of the outcomes is zero and therefore the productivity is zero.

Thus the budget process can and does depend on the overall competence and awareness by school managers of the value of the items to be included in the budget. How competent are the school managers on ICT integration in the teaching learning process? Which components should be itemized on the budgets? What is the mission and vision of the school? The head teacher is the operational leader of a school and represents the entire staff on the board of governors (BOG). A board can only be as effective as the head teacher. Leadership plays a key role in ICT integration in education. Many teacher- or student-initiated ICT projects have been undermined by lack of support from above. For ICT integration programs to be effective and sustainable, administrators themselves must be competent in the use of the technology, and they must have a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education.

Equipment of Schools with ICT Tools and Overall national Infrastructure Provisions.

A country's educational technology infrastructure sits on top of the national telecommunications and information infrastructure (Romulo, 2002). Before any ICT-based programme is launched, policymakers and planners must carefully consider the following:

In the first place, are appropriate rooms or buildings available to house the technology? In countries where there are many old school buildings, extensive retrofitting to ensure proper electrical wiring, heating/cooling and ventilation, and safety and security would be needed.

Another basic requirement is the availability of electricity and telephony. In developing countries large areas are still without a reliable supply of electricity and the nearest telephones are miles away. Experience in some countries in Africa point to wireless technologies (such as VSAT or Very Small Aperture Terminal) as possible levers for leapfrogging. Although this is currently an extremely costly approach, other developing countries with very poor telecommunications infrastructure should study this option. In Uganda, although telecommunication service providers such as MTN, Orange, Airtel, Warid and UTL seem to have spread to every corner of the country, the wireless internet service for all operators is still unreliable and 3G platforms are confined to busy urban locations.

Policymakers should also look at the ubiquity of different types of ICT in the country in general, and in the educational system (at all levels) in particular. For instance, a basic requirement for computer-based or online learning is access to computers in schools, communities, and households, as well as affordable Internet service.

In general, ICT use in education should follow use in society, not lead it (Romulo, 2002).

Education programs that use cutting-edge technologies rarely achieve long term success: It is cheaper, and easier, to introduce a form of technology into education, and keep it working, where education is riding on the back of large-scale developments by governments or the private sector. Television works for education when it follows rather than precedes television for entertainment; computers in schools can be maintained once commercial and private use has expanded to the point where there is an established service industry.

Use of ICT and Access to ICT

-Integrating ICT in the Learning Process

Educational Technology should be selected on the basis that it has the best characteristics for the implementation of the curriculum. An educational technology should be used effectively or not at all. This requires:

- Teachers who know how make use of the technology effectively.
- Teachers and students who know how to operate the technology.

While it would be convenient to be able to make a direct connection between the use of ICT and learning outcomes, most reputable educational researchers today would agree that there will never be a direct link because learning is mediated through the learning environment and ICT is only one element of that environment. Studies that have tried to identify this mediated impact of ICT on learning have found it impossible to entirely remove the effects of other elements of the learning environment. There is little purpose in attempting to compare the cognitive outcomes when using computers, with using a textbook or some other resource. Salomon (1994) supports this view by arguing that it is not possible to study "the impact of computer use in the absence of the other factors" nor to assume that "one factor impacts outcomes independently of the others" (p. 80). The educational aim is to embed the computer support in the learning environment (DeCorte, 1990), rather than to try to isolate its effect on learning. Using computers in learning is concerned with methods of using the technology to create environments and learning situations. There have been many decades of solid educational research, not necessarily related to using computers, on which to base decisions about appropriate applications of computers to learning. For example, Mevarech and Light (1992) suggest that the relationships between student characteristics, learning environments, behaviours and schooling outcomes are crucial and need further research, yet there has been much research which has considered these relationships in other contexts than educational computing. Rieber and Welliver (1989) criticise media comparison studies, claiming that they were of no value applied to research into the use of educational television and therefore many question their value to educational computing research. Therefore in implementing computer applications it is necessary to start by deciding what a student, teacher or school wants to achieve. To achieve these outcomes, teachers can then rely on long traditions of educational theory, their own experience and knowledge of the educational situation (e.g. student attributes) to make decisions about what the learning environment should look like and what inputs into the learning process are required. Finally, teachers can identify what problems are associated with providing these environments and inputs and tailor computer and other support to provide solutions. This approach ends with decisions concerning computer support rather than starting with such decisions (Campione et al., 1990).

Is there equity of access to ICTs in education?

Given the wide disparities in access to ICTs between rich and poor countries and between different groups within countries, there are serious concerns that the use of ICTs in education will widen existing divisions drawn along economic, social, cultural, geographic, and gender lines. Ideally, one wishes for equal opportunity to participate. But access for different actors—both as users and producers—is weighted by their resources. Hence, initial differences are often reproduced, reinforced, and even magnified. A formidable challenge, therefore, continues to face planners of international education: how to define the problem and provide assistance for development (Hernes, 2002). The introduction of ICTs in education, when done without careful deliberation, can result in the further marginalization of those who are already underserved and/or disadvantaged (Hernes, 2002). For example, women have less access to ICTs and fewer opportunities for ICT-related training compared to men because of illiteracy and lack of education, lack of time, lack of mobility, and poverty (Tandon, 1998). Boys are more likely than girls to have access to computers in school and at home. Not surprisingly, boys tend to enjoy working with computers more than girls (Mark, 2002). As the American Association of University Women reports, "Girls have narrowed some significant gender gaps, but technology is now the new 'boys' club' in our nation's public schools. While boys programme and problem solve with computers, girls use computers for word processing...". In an evaluation of its programme in four African countries, Worldlinks, an organization that promotes project-based, international tele-collaboration activities among secondary school teachers and students from developing countries, it was found that despite efforts to make the programme gender neutral, gender inequalities in access persist in Uganda and Ghana. Furthermore, while girls benefited more from the programme in terms of improved academic performance and communication skills, boys were able to hone their technological skills more. A complex of economic, organizational, and

Socio-cultural factors account for these differences: "High student-to-computer ratios and first come first serve policies do not favour girls (typically heavily outnumbered by boys at the secondary level), girls have earlier curfew hours and domestic chore responsibilities which limit their access time, and local patriarchal beliefs tend to allow boys to dominate the computer lab environment." (Gadio, 2001). Measures proposed to address this gender bias include encouraging schools to develop "fair use" policies in computer labs, conducting gender sensitivity sessions, and advocating for reducing the after-school duties of girls to give them more time to use the computer lab. Girls also need to have female role models to inspire them to participate in technology-related activities. Providing access to ICTs is only one facet of efforts to address equity issues. Equal attention must be paid to ensuring that the technology is actually being used by the target learners and in ways that truly serve their needs. An ICT-supported educational programme that illustrates this wholistic approach is the *Enlace Quiché*: Bilingual Education in Guatemala Through Teacher Training programme. The programme seeks to establish and maintain bilingual education technology centres for educators, students, teachers, parents, and community members.

Is there any tangible benefit in using ICT in the Teaching-Learning Process? Insight from research

A report from the ImpaCT2 study (Becta, 2002) conducted in the UK found that, "There is no consistent relationship between the average amount of ICT use reported for any subject at a given key stage and its apparent effectiveness in raising standards. It therefore seems likely that the type of use is all important."

There can be a positive impact

While there is no direct link between using ICT and student learning the weight of evidence now clearly shows that indirectly there can be a significant positive impact. Over the past 30 years there has been an increasing amount of research conducted to investigate this impact with increasingly clearer findings of positive impacts when ICT is used appropriately.

> On average, students who used computer-based instruction scored at the 64th percentile on tests of achievement compared to students in the control conditions without computers who scored at the 50th percentile. (Schacter, 1999)
>
> West Virginia's Basic Skills/Computer Education program was more cost effective in improving student achievement than (1) class size reduction from 35 to 20 students, (2) increasing instructional time, and (3) cross age tutoring programs. (Mann et al., 1999)

> Differences in attainment associated with the greater use of ICT were clearly present in more than a third of all comparisons made between pupils' expected and actual scores... (Becta, 2002)
>
> Given the right conditions for access and use, significant gains in student learning are recorded with ICT. (Laferrière, Breuleux, & Bracewell, 1999)

Since learning is mediated through the components of the learning environment and particularly the curriculum (pedagogy and content) therefore it is useful to start with a consideration of the impact of ICT on the curriculum.

ICT and the Learning Environment

ICT allows students to investigate more thoroughly the real world (Réginald Grégoire inc., Bracewell, & Laferriére, 1996; Riel, 1998). They can more readily access information sources outside the classroom and can use tools to analyze and interpret such information. Information may be accessed through online systems or through data logging systems (Riel, 1998). The technologies allow them to receive feedback, refine their understanding, build new knowledge and transfer from school to non-school settings (Committee on Developments in the Science of Learning, 2000). In the past this has been difficult to provide in schools due to logistical constraints and the amount of material to be covered all of which can now be addressed with ICT support (Committee on Developments in the Science of Learning, 2000). Feedback can also be more on the basis of how experts reason (Committee on Developments in the Science of Learning, 2000). What can be learned is broadened and deepened (Réginald Grégoire inc. et al., 1996).

The interactive and multimedia nature of modern computer systems has provided the opportunity for software developers to create increasingly more stimulating features. Many studies have found that students like to use computers and are likely to develop more positive attitudes towards their learning and themselves when they use computers (Réginald Grégoire inc. et al., 1996; Schacter, 1999). Computer systems do provide the opportunity to create a wide range of interesting learning experiences (Committee on

Developments in the Science of Learning, 2000). This is likely to help maintain student interest and interest a wider range of students (Cradler & Bridgforth, 2002). The interactive and multimedia features within software can be used to help students grapple with concepts and ideas (Committee on Developments in the Science of Learning, 2000). Students can more readily be provided with similar information and experiences within a variety of contexts (Committee on Developments in the Science of Learning, 2000)

Learner Independence

Computer systems are increasingly being used to provide learning experiences when and where they are needed. This provides students with greater independence not only in terms of when and where they learn but also what they learn (Cradler & Bridgforth, 2002). It is not necessary for all students to do the same thing at the same time. Teachers may provide students with access to software allowing students to select different learning experiences. The class does not have to be treated as one group. Individuals or groups of students may consider learning topics independently of the teacher (Réginald Grégoire inc. et al., 1996). This is often discussed in terms of lifelong learning, learner-driven learning or project-based learning (Riel, 1998). ICT tools can be used to create records of thoughts and support.

ICT Components as a Learning Environment

ICTs provide the support to extend the possibilities for creating learning environments (Committee on Developments in the Science of Learning, 2000). The most important entities in determining a classroom environment are the teachers. In most classrooms it is the teacher(s) who decides what content is important, directs student learning, assesses student learning, structures the environment (e.g. rules and routines) and chooses and provides the materials to be used. However, the student role is also critical.

Teacher-Student Roles in the ICT Environment

The teacher will always have a role in directing what and how students learn whether this is by controlling the instruction or providing the learning situations. The students will always play both passive and active roles in the teaching and learning scenarios. It is suggested that the balance of control and roles is likely to shift towards student participation with the use of ICT to support learning processes. This transfer of roles or control often occurs spontaneously and naturally in a classroom within an activity (Committee on Developments in the Science of Learning, 2000). Riel (1998) concludes that the balance of control may ultimately not be "under the complete control of the teacher, nor under the complete control of the learner" with the "inclusion of many people with differing expertise" as ICT is used to support a learning community.

Innovations involving the use of computers invariably place additional demands on students. For the students it may represent a new approach to learning in which they have to develop confidence and competence. It has been noted that there may be significant changes to their role which are complementary to changes in the teacher's role. This may require them to develop skills concerned with taking more responsibility for learning and relying less on the teacher. They may need to develop skills in making decisions for themselves and with other students. In addition, practical skills such as the ability to follow instructions presented on paper, by a teacher or on a computer screen need to be developed. Students will also need to develop skills in determining and assessing their own learning. For example, self-directed learning using computers usually implies the use of more visual forms of instruction and information than verbal. Therefore students need to have increased levels of comprehension and concentration. Students need to develop skills in recording and evaluating their findings and progress. With the help of the teacher they need to be able to interpret their findings and make decisions about directions for learning.

The Teacher's Unassailable Role

According to Newhouse (2002), the computer can provide a variety of response situations and provides positive feedback. This allows teachers to give consideration to the individual needs of students which traditionally has been a problem with large numbers of students and very little time. The computer takes on part of the instructional role of the teacher with the teacher managing the instruction. The software needs to be matched to the curriculum and therefore is typically content or skills based. There are many educators who feel that this is a trivial or inappropriate use of a computer. However, such software may be used in the development and maintenance of lower level skills (sub-skills) necessary for later progress. There is a danger that such applications focus on student memory of content, although they can be developed to focus on student understanding. These applications are usually easy for teachers to integrate with the curriculum and implement in the classroom.

While it appeals to the public imagination (computers teaching students) even the best tutorial package can't adequately replace an average teacher (Newhouse, 2002). Tutorial software may be useful as supplementary material for some students for enrichment and remedial situations. Some research has shown improvements in skills such as reading, language arts and mathematics of up to 30% when computer-based tutorial and drill and practice software are used (Mann et al., 1999). These applications have become increasingly sophisticated with the higher quality packages implementing strategies based on many years of educational research, for example, expert systems and cognitive tutors and apprentices (Committee on Developments in the Science of Learning, 2000) in their teaching" (Lankshear & Snyder, 2000, p. 121) much of this support may be accessed more readily using ICT (Réginald Grégoire inc. et al., 1996).

Related Studies

ICT and the learning outcomes

The major rationale for having computers in schools was more concerned with the need to use computers to improve student learning (Welle-Strand, 1991). Broadly speaking, computer literacy is a component of Technology Education, which is distinct, but not necessarily separate from, using technologies such as computer systems to support learning and teaching processes. The latter is generally referred to as educational technology; and is applied to a wide range of technologies such as blackboards and chalk, pencils, books, and slide-rules to television, facsimiles, and computers. This review is focused on the use of computer systems as educational technologies. Since the beginning of the 1990s, educators have been particularly concerned that very little of the potential of computers to support learning in schools seems to have been realised, despite a sufficient installed base of computers. Numerous studies (Becker, Ravitz, & Wong, 1999; DeCorte, 1990; Plomp & Pelgrum, 1992) have shown that few teachers facilitate substantial student use of computers.

An increasing number of educators (e.g. Schlechty, 1997) are sure that part of the solution is to provide better technology support for learning environments. Schank and Cleary (1995) argue that we know enough about learning to support it with computer systems, using software that allows children to experience activities, at school, that have been impossible or difficult, and thus avoided in the past. At the school and system levels the educational-problem question becomes whether the resources available to the school are being most efficiently employed to provide the most effective educational opportunities for students. It becomes much more a question of productivity, a balance between inputs (resources) and outputs (learning outcomes). Investing in computer technology means reducing investment in other resources (e.g., books, teachers, buildings). Will using computers provide better learning outcomes than the equivalent investment in those other resources? If so, what level of investment in computers compared with other resources will provide the optimum output? Very few educators and educational commentators would advocate no investment in computers, even if only using a computer literacy rationale. A few advocate an investment that supports almost all education being conducted electronically, particularly online, often referred to as e-learning (Bonk, 2001).

According to excerpts from *info*Dev's Knowledge Maps: ICTs in Education – "What do we know about the effective uses of information and communication technologies in education in developing countries?"

(Trucano, Michael. 2005. Knowledge Maps: ICTs in Education. Washington, DC: *info*Dev / World Bank)

It is generally believed that ICTs can empower teachers and learners, promote change and foster the development of '21st century skills, but data to support these beliefs are still limited

There is widespread belief that ICTs can and will empower teachers and learners, transforming teaching and learning processes from being highly teacher-dominated to student-centered, and that this transformation will result in increased learning gains for students, creating and allowing for opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communication skills, and other higher-order thinking skills. However, there are currently very limited, unequivocally compelling data to support this belief.

ICTs are very rarely seen as central to the overall learning process

Even in the most advanced schools in OECD countries, ICTs are generally not considered central to the teaching and learning process. Many ICT in education initiatives in LDCs seek (at least in their rhetoric) to place ICTs as central to teaching and learning.

An enduring problem: putting technology before education

One of the enduring difficulties of technology use in education is that educational planners and technology advocates think of the technology first and then investigate the educational applications of this technology only later.

Impact on student achievement

The positive impact of ICT use in education has not been proven In general, and despite thousands of impact studies, the impact of ICT use on student achievement remains difficult to measure and open to much reasonable debate.

Positive impact more likely when linked to pedagogy It is believed that specific uses of ICT can have positive effects on student achievement when ICTs are used appropriately to complement a teacher's existing pedagogical philosophies.

'Computer Aided Instruction' has been seen to slightly improve student performance on multiple choice, standardized testing in some areas
Computer Aided (or Assisted) Instruction (CAI), which refers generally to student self-study or tutorials on PCs, has been shown to slightly improve student test scores on some reading and math skills, although whether such improvement correlates to real improvement in student learning is debatable.

Need for clear goals
ICTs are seen to be less effective (or ineffective) when the goals for their use are not clear. While such a statement would appear to be self-evident, the specific goals for ICT use in education are, in practice, are often only very broadly or rather loosely defined.

There is an important tension between traditional versus 'new' pedagogies and standardized testing
Traditional, transmission-type pedagogies are seen as more effective in preparation for standardized testing, which tends to measure the results of such teaching practices, than are more 'constructivist' pedagogical styles.

Mismatch between methods used to measure effects and type of learning promoted

In many studies there may be a mismatch between the methods used to measure effects and the nature of the learning promoted by the specific uses of ICT. For example, some studies have looked only for improvements in traditional teaching and learning processes and knowledge mastery instead of looking for new processes and knowledge related to the use of ICTs. It may be that more useful analyses of the impact of ICT can only emerge when the methods used to measure achievement and outcomes are more closely related to the learning activities and processes promoted by the use of ICTs.

ICTs are used differently in different school subjects

Uses of ICTs for simulations and modeling in science and math have been shown to be effective, as have word processing and communication software (e-mail) in the development of student language and communication skills.

Access outside of school affects impact

The relationships between in-class student computer use, out of class student computer use and student achievement are unclear. However, students in OECD countries reporting the greatest amount of computer use outside school are seen in some studies to have lower than average achievement (the presumption is that high computer use outside of school is disproportionately devoted to computer gaming).

Users believe that ICTs make a positive difference

In studies that rely largely on self-reporting, most users feel that using ICTs make them more effective learners.

There has been extensive research on computer assisted instruction (CAI) and computer based learning (CBL). Some major reviews of this extensive work have been undertaken. One study (Flether-Flynn and Gravatt, 1995) into the effectiveness of CAI limited the studies it examined to those that took place between 1987 – 1992 and identified almost 400 reports of research that met these criteria. The impact of the use of computers was then combined statistically to identify the overall impact. In this meta-analysis the mean effect size was relatively small (0.24) for the five years in question but increased for more recent studies analysed (0.33). This kind of improvement would move an average class of students from 50^{th} to about 40^{th} in a list of 100 classes ranked in order of attainment. This suggests two things: first, it is possible that the impact of ICT is increasing; second, that ICT only produces a relatively small improvement.

A study by the British Educational Technology Association (BECTA, 2000) found no link between level of resources for ICT and either reading or mathematics grades at key stage 1 in 1999. At key stage 2 there was a significant but very weak correlation between ICT resources and pupil attainment. In the USA, information about computer use from a longitudinal study was analysed (Weaver, 2000). This study also found a very small link between computer use in curriculum in school and improvement in pupils' test scores and the link was very weak (no correlation coefficient was higher than 0.035 for science, mathematics and reading) which again indicates that at this stage computer use makes very little difference to pupils' achievement.

One UK project that investigated how the sustained and embedded use of ICT in learning spaces can improve learner outcomes is the Test Bed project, conducted from 2002 to 2006. The evaluation of the project confirms that technology deployment and use may lead to an improvement in test performance relative to 'benchmark' comparators. The rate of improvement in Test Bed schools and LAs (Local Authorities) for some tests was higher than that for benchmark comparator LAs. In English Key stage 3, Test Bed LAs improved by 4.68% between 2002 and 2004, while comparator LAs improved by 4.09. Test Bed schools in key stage 3 mathematics tests in 2004 improved significantly compared to their performance between 2002 and 2003. In addition the number of secondary pupils achieving A to C GCSE grades had significantly improved over the course of the project. The Test Bed Project shows that e-maturity makes a difference. Schools with higher levels of e-maturity demonstrate a more rapid increase in performance scores than those with lower levels. Just one year after new equipment had been installed in the ICT Test Bed schools there was improved attainment. Thus, from this report, it is possible to quantify the effect of an ICT investment and to show the cost of achieving an improved outcome. It should be noted, however that the evaluation report presents only preliminary findings from the ICT Test Bed project. We cannot be sure, however, whether this improvement has been sustained.

The recent UK study 'New Technology in schools: is there a pay off?' (2006), also finds evidence for a causal link between a substantial increase in ICT investment and a rise in educational performance in primary schools. This is most evident in the teaching of English and Science, yet no positive impact is observed for Mathematics.

CHAPTER 3:

METHODOLOGY

Research Design

This study applied an experimental research design. It was important to determine whether there was a causal relationship between the use of ICT methodology and learning achievement. More over, it was imperative to find out why schools were not upbeat about the use of ICT in the teaching-learning process, despite all the acclaim and apparent benefits resulting from the method.

Research Population

Two schools (Mbale S.S and Nkoma S.S) that use ICT equipment and four schools(Mbale High S, Bugisu High S, Oxford High and Comprehensive S. S) that apply the traditional teaching-learning style provided the population from which samples were taken. The sample size of 6 out of a total of 30 schools was a stratified sample: 2 out of 3 ICT schools and 4 out of 26 non ICT schools. There was a total of 720 S2 students and 330 teachers.

Sample size

There are two categories of general recommendations in terms of minimum sample size in factor analysis. One category says that the absolute number of cases (*N*) is important, while the another says that the subject-to-variable ratio (*p*) is important. Arrindell and van der Ende (1985), Velicer and Fava (1998), and MacCallum, Widaman, Zhang and Hong (1999) have reviewed many of these recommendations. In the subjects – to – variable ratio, Rule of 10, there should be at least 10 cases for each item in the instrument being used. (David Garson, 2008; Everitt, 1975; Everitt, 1975, Nunnally, 1978, p. 276, in Arrindell & van der Ende, 1985, p. 166; Kunce, Cook, & Miller, 1975, Marascuilor & Levin, 1983, in Velicer & Fava, 1998, p. 232)

Twelve teachers were sampled from every school and their responses were sought on 20 items presented in a Likert-type questionnaire (the Teachers' Tool). The twelve teachers were to represent twelve subject areas, which was the average number for most schools. USE schools have 10 subject areas.

Fifteen students were sampled in each of the non-ICT schools giving a total of 60 students out of 320 students. A total of forty eight students were sampled out of 400 from the two ICT schools. There were 3 teachers during lesson time : 1 for lesson delivery and 2 for support.

Sampling Procedure

The students were randomly selected from their streams while taking care of gender balance. Teachers were selected through a stratified sample – one teacher from every subject area.

Research Instruments

The research instruments used included the Teachers' Tool (see appendix), the student test on 'solubility of salts' and an Inspection/Observation Tool. The Teachers' Tool was administered to the teachers and it was a Likert – type 20-item questionnaire. Students were subjected to a 20-item test after applying either the pure ICT-Integrated approach or the traditional method.

Validity and Reliability of the Instruments

Data quality control refers to validity and reliability of the instruments. Validity refers to the appropriateness of the instruments while reliability refers to its consistency in measuring whatever it is intended to measure. The pretesting of the instrument was done before the actual exercise and modifications were made. For instance the instrument was initially gathering opinion on various variables. This was changed to capture what the teachers were doing. Reliability of the instrument was ensured

CHAPTER 4

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA.

The findings include the feedback from the teachers, the results of pre –test and post-test and the observations made during inspection of the facilities and the teaching – learning process. These results have been presented in the appendices. Some illogical responses were noted from the teachers questionnaire. Whereas a significant proportion (48.57%) of teachers claimed they used technology, the findings from the inspection carried out differed from this position. One question was not answered by a teacher and it was considered as 'not sure'. One extra student was considered in student samples to take care of experimental mortality and invalidated filled tools. Every student was allowed to hand in the post – test script individually to allow for validation. This explains why it was not necessary to have more than one extra student in a given sample. The sample sizes were also influenced to some extent by the ICT and textbook materials made available. The major outcome variable (observation) was a constructed – response achievement test on the lesson material.

Capability of Teachers to apply ICT – Integrated Approaches

Table 1. Competence of Teachers

Type of School	Sample size	Number of Teachers applying technology in the teaching-learning process.	Number of teachers requiring in-service training
ICT schools	24	10	20
Non-ICT schools	46	21	38
Total	70	31 (48.5%)	58 (82.8%)

While 48.57% of the teachers claimed they were applying technology in the teaching – learning process, 44.28% said they were not. Some 7.2% were not sure whether they were applying technology or not. When compared with the inspection findings, the actual percentage could have been much lower. The apparent sense of guilt for not putting into practice a professional requirement was probably the major influence in the kind of response seen here. Two types of technology should be looked at in this context: innovative technology from local resources and ICT equipment. Except for the ICT schools, there was nothing in form of ICT kits seen in the non- ICT schools.

From related studies:

National competence development programmes have had limited impact on teachers' pedagogical competences. School leaders estimate that the impact of ICT on teaching methods in their school is low (Ramboll Management, 2006).

Teachers' basic ICT skills have increased dramatically (Kessel, 2005).
Teachers teaching science, mathematics and computer science (22%) and active in vocational education 23% are the most intensive users of the computer (Empirica, 2006).

Teachers use ICT to support existing pedagogies. ICT is used most when it fits best with traditional practices (Underwood, 2006).

ICT can enhance teaching by enhancing what is already practiced or introducing news and better ways of learning and teaching (EUN, 2004).

The greatest impact is found in relation to teachers who are experienced users and who from the start had already come far with the integration of ICT in their teaching. Teachers who perceive a highly positive impact of ICT use ICT in the most project-oriented, collaborative and experimental way (Ramboll Management, 2006).
The impact of ICT is highly dependent on how it is used. The impact of a specific ICT application or device depends on the capacity of the teacher to exploit it efficiently for pedagogical purposes. Factors beyond the teacher's control influence ICT uptake, e.g. institutional cultures, leadership, the curriculum and assessment (Ramboll Management, 2006, Ramboll Management, 2005).
Teachers do not yet exploit the creative potential of ICT and engage students more actively in the production of knowledge. Teachers' use of ICT for communication with and between pupils is still in its infancy. ICT is underexploited to create learning environments where students are more actively engaged in the creation of knowledge rather than just being passive consumers (Kessel, 2005, Ramboll Management, 2006, Ramboll Management, 2005).

School Budget Provisions

Table 2: Budgeting in ICT schools (priority areas)

	ITEM	Mbale ss	Nkoma ss
	overall income	3600x100,000= UGX 360M	USE GRANT UGX 120M
1	Building Fund	UGX 120M (33%)	UGX 30M (33%)
2.	Library fund	UGX 5M (1.4%)	UGX 3M (2.5%)
3	Stationery	UGX 15M (4.2%)	UGX 10M (8.3%)
4	Furniture	UGX 10M (2.8%)	UGX 5M (5.5%)
5	Teachers welfare	UGX 72M (20%)	UGX 10M (11%)
6	Departmental requirements	UGX 20M (5.6%)	UGX 15M (16.5%)
7	Academic Trips	UGX 38M (9.6%)	UGX 27M (29.2%)
8	Co-curricular, Games & Sports	UGX 52M (19.6%)	UGX 18M (15%)
9	Miscellaneous	UGX 28M ((5.76%)	UGX 2M (1.7%)

All schools did not have ICT equipment on their budgets. While 92.8% of the teachers believed the equipment needed to be included on the budgets, school administrators did not have this view. The only consideration afforded by the schools was for the candidate students and during the final examination period (third term). School administrators seemed scared of the cost of ICT equipment and so never made even a modest effort to acquire the basic items. One computer, a modem and a power unit cost not more than UGX 1.5 million ($400). This was affordable to most schools. In their adverts, private schools never ceased to remind the public about the fact that they were equipped with computers, among other facilities.

A highly relevant factor for the success of projects is the general support of the organization where the initiative is based. This support can express itself in different dimensions like financing, equipment, personnel, or the readiness to adapt organizational structures like time schedules. A relevant intermediate factor for success is the presence of sufficient funds to establish and maintain the necessary technological infrastructure and keep the project running. The existence of a flexible organizational structure and a general openness to pedagogical innovation is an asset (Heid et al, 2009).

The effective development of a digital school requires principals to understand and support ICT and its uses in the curriculum. Due to the high costs and technology implications, "principals can no longer delegate major technology decisions to IT specialists or ignore the importance of ongoing professional learning for themselves and their staff" (Lee & Gaffney eds. 2008). But the reality is that schools in comparison to other information-rich industries, have grossly inadequate funding for both the technology and the associated staff development (Richardson, 2007).

Accessibility and use of ICT Equipment

About 20% of the teachers thought the application and use of ICT is a task for science teachers. The teachers of history or Kiswahili did not think they are part of this new development. Approximately 61% of the teachers did not get access to internet. There were only 33% who claimed they had access. One question however is 'what were the teachers actually doing with the internet – connected PCs?' Did they use the computers to prepare their lessons? Or did they engage in collaborative work with other teachers across the globe? The findings were that there was no evidence of participation in a wiki or blog. There was no material sourced from other parts of the world to boost local content.

There is no doubt that teachers who use ICT in classrooms have to demonstrate high levels of energy, hard work and perseverance, often in the "face of considerable odds" (Lankshear & Snyder, 2000). If they are early adopters then they are required to be resourceful and overcome many barriers to "make things work". Planning learning experiences involving computers takes considerable time and demands complex scheduling and resourcing. Therefore, teachers using computers in the classroom should not act in isolation from each other. They need to have access to resources which will supply ideas and material for different classroom applications. Schools need to subscribe to relevant journals and have publications which will enable teachers to gain ideas for classroom uses. Teachers within schools can also be used to provide ideas and activities to peers so that valuable uses can be identified and implemented by others (Newhouse, 2002).

The table below matches possible implications for teachers with the potential reasons for using computers in the classroom. The implications which would result in advantages to the teacher are indicated with an *. From the teacher's point of view there are likely to be many more disadvantages or difficulties than advantages.

The Implications for Teachers in Using Computers in Classrooms.

Potential	**Implications for Teacher**
Dynamic learning	Students may learn outside the teacher's own area of expertise.
	More difficult to direct and manage student learning.
Student motivation	Students are easier to manage and direct towards the tasks.*
	Students may be distracted by the computer from the tasks the teacher has intended.
Removing tedious tasks	More satisfying for teacher to direct less tedious tasks.*
	Some teachers may prefer students to complete tedious,

routine tasks

as "busy" work.

Instruction to fit the

Learner Relieves the teacher from needing to spend a lot of time with

students

who need extra practice, catch-up or extension work.*

Independent learning Learning may not direct itself towards the teacher's

objectives.

Additional coordination of the classroom, students and

materials is

required.

Extending student

Thinking Student thinking may go beyond the teacher's experience or capabilities which may reduce the confidence of the teacher.

While computers may be seen to have great potential in education, at the same time they present teachers with some additional obstacles to overcome. Most of the potential benefits are directed towards the student in improved learning and instruction. Very few of the benefits are directed towards the teacher's tasks in the classroom. More importantly it is not clear that this potential is associated with the aims and objectives which teachers (and students) bring to the classroom environment. For these and other reasons many teachers have only made limited, if any, use of computers in their teaching programmes (Newhous, 2002).

Training provided by Teacher Colleges and Schools

The teacher training colleges in Uganda did not provide adequate exposure of their students to ICT methodologies. The responses to Q7 in the Teachers' Tool show that 82.9% (md 0.32) of the teachers felt they needed in-service training (Table 1) before applying ICT in the teaching-learning process. At school level, training had been carried out for few teachers (not more than 3) in ICT schools. While apportioning blame to

Teacher Colleges, it is instructive to recall that many of the individuals working in casinos, game worlds, DVD/Video vending booths and computer hardware workshops have not had formal training of any kind. It was just interest, initiative and a little motivation that drove them into these trades.

The limited ICT knowledge makes teachers anxious about using ICT in the classroom and thus do not feel confident to embrace new pedagogical practices. The 2004 Becta survey on the perceived barriers to the uptake of ICT by teachers also refers to the teachers' fear of admitting to their pupils their limited ICT knowledge. In addition Elearning Nordic shows that teachers who do not experience any impact of ICT asses that they, only to some or a lesser degree, have sufficient ICT competences to integrate ICT into their teaching.
The Eurobarometer Benchmarking survey (Empirica 2006) analysed teachers' data according to the Access, Competence and Motivation Model (CTS) developed by Viherä and Nurmela (2001). It found that more than 80% of the European teachers describe themselves as competent in using computers and the internet in classroom situations, two-thirds have the necessary motivation for doing so (in their own opinion), and 60% describe the ICT infrastructure in their schools and the internet connection as sufficiently rapid. However, there are large variations across the countries on all three dimensions. In some countries, for example, more than half of the teachers do not feel competent yet to use the ICT infrastructure in the classroom, with Greece (60%), Portugal (70%), Hungary (71%) and France (76%) ranking at the bottom end. It appears as if motivation seems to be a critical factor, since 14% with access lack both motivation and competence and another 10% also lack motivation despite their competence and access to ICT.

Enthusiasm and Interest from Head Teachers

A few head teachers may have had interest in the application of ICT in the teaching – learning process but there were other factors at play. Although 61.4% admitted it was not just the lack of keen interest from head teachers, 31% thought otherwise (see Q5, Teachers' Tool). The wide variation among the teachers' position was confirmed by the greatest mean deviation of 1.29 for any response. Head teachers are not molded from a different fabric, what applies to the ordinary teachers includes them. Another spin to the head teachers situation is the collective position of the board that he/she has to keep up with.

Attitude of teachers toward ICT Methodology

There were 88.5% of the teachers who admitted that ICT – Integrated teaching-learning methodologies enhance the retention capacities of learners. Those who felt they were enthusiastic for the benefits of the method were 81.4% (md 0.654). This corroborates well with the results from the Students' Tool which show that in Nkoma SS the attainment when the Traditional and mixed ICT – Integrated Teaching – Learning method are blended was an average 41.25 for Group 1 with a standard deviation of 12.99. Similarly, in Mbale SS, Group 1 had a post - test average of 42.5 with a standard deviation of 11.28, while Group 2 (pure ICT – Methodology) had an average of 45 with a standard deviation of 14.62. These were the highest averages for all the schools. Approximately 72.8% of the teachers admitted that they would acquire ICT teaching skills by infection. With this type of mind set the teachers were not sure where the inspiration would originate from.

The Nordic study found that the impact of ICT is highly dependent on how it is used. Teachers see the greatest impact of ICT in quite different teaching and learning situations. Some teachers feel ICT has greatest impact when used as a tool to create a physical product, others see ICT as a powerful tool to support group and project work. School culture and the personal views of teachers working with ICT determine to a large extent specific ICT uses.

Previous studies (EUN, 2002) have shown that there are also major differences between

primary and secondary schools regarding the integration of ICT by teachers. As e-learning Nordic also shows, primary teachers more often regard ICT as supporting their pedagogical and didactical teaching methods than teachers in secondary school. It would be interesting to describe the teaching methods used
in primary schools and the way ICT is supporting these and relate them to the contextual factors for ICT use in a primary school context (timetables, size of class, curriculum). On the other hand, the European Benchmarking report shows
that despite good general conditions in primary schools, the potential is not exploited with only 17% of primary education teachers using computers in their classes.

Level of Usage of Available Equipment.

Uganda Communication Commission (UCC) had supported selected schools in Uganda by providing each with 40 monitors, 4 CPUs, 4 UPSs, 1 projector, a portable white board and some educational programs. In Mbale district only 3 schools had benefitted from the UCC program. The equipment were inadequate given the student enrolment in these schools. It was clear from this gesture that the Commission's Cyber Program was aimed at kick – starting a major shift from traditional to a technology driven teaching-learning process.

In Mbale SS, where there was internet connectivity, there was no evidence of how the teachers had made use of this facility in the teaching – learning process. There was neither downloaded nor uploaded subject content in the school. School budgets could be stretched a little to acquire some facilities that would allow an updated content for teachers who are beset with yellow notes. Teachers in most schools in Uganda rely either on the textbooks provided by the school where they teach or the notes made by their colleagues.

Related studies have shown that:

In courses using computer-based networks, many students who seldom
participated in face-to-face class discussions became more active participantsonline.

(The Software Information Industry Association., 1999)

Introducing technology into the learning environment has been shown to make learning more student-centered, to encourage cooperative learning, and to stimulate increased teacher/student interaction. (The Software Information Industry Association., 1999)
An evaluation of IMMEX Teacher Institutes have shown statistically significant improvement in teacher preparation to: use cooperative learning groups (WestEd, 1998)
The use of ICT encourages teachers to use more cooperative work and less teacher lecturing (Baker et al., 1994).

The studies show that with good management, increased usage of ICT equipment is almost always automatic.

Test of Hypothesis

Table 3: The mean, standard deviation and sample sizes for all groups.

	School			Mean	Standard deviation (s)	Sample size (n)
1	Nkoma S.S (ICT School)	Grp 1	Pretest	8.75	10.47	12
			Post-test	41.25	12.99	12
		Grp 2	Pretest	15.42	17.51	12
			Post-test	31.25	8.56	12
2	Bugisu High School		Pretest	29.67	10.93	15

			Post-test	35.33	9.15	15
3	Mbale S.S (ICT School)	Grp 1	Pretest	22.5	13.06	12
			Post-test	42.5	11.18	12
		Grp 2	Pretest	21.67	11.15	12
			Post-test	45	14.62	12
4	Comprehensive High S		Pretest	16	12.56	15
			Post-test	41	12.13	15
5	Mbale High School		Pretest	13	13.99	15
			Post-test	40.67	18.79	15
6	Oxford High School		Pretest	13	12.65	15
			Post-test	37.33	14.38	15

The hypothesis

Ho: there is no difference between the methods,

was tested against the alternative

H1: the ICT-integrated method is superior.

The result of the tests showed:

At df=25, $t_{0.1}$= 1.708. The calculated t – statistic was 1.791. We reject the null hypothesis and accept the alternative in the case of Mbale SS and Bugisu High School. The other comparisons and calculations show that we accept the null hypothesis and reject the alternative for Table 1A (Appendix).

At df=25, $t_{0.05}$= 2.06, $t_{0.1}$= 1.708. The calculated values are 2.44 (Nkoma SS and Comprehensive) and 1.73 (Nkoma SS and Mbale High School). We reject the null hypothesis at 95% and 90% levels of significance. In other comparisons we accept the null hypothesis and reject the alternative for Table 1B (Appendix).

Graphical considerations

Suppose that the group that was exposed to the traditional method is the control group. We find that the paired groups will not only differ in their means but also variability.

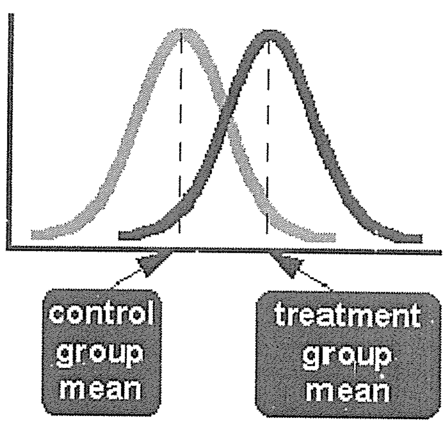

Figure 1. Idealized distributions for treated and comparison group posttest values.

Figure 1 shows the distributions for the ICT (blue) and control (green) groups in this study. Actually, the figure shows the idealized distribution -- the actual distribution would usually be depicted with a histogram or bar chart. The figure indicates where the control and treatment group means are located. The question the t-test addresses is whether the means are statistically different.

What does it mean to say that the averages for two groups are statistically different? Consider the three situations shown in Figure 2. The first thing to assume is that, for the three situations, the difference between the means is the same in all three. But, one should also notice that the three situations don't look the same -- they tell very different stories. The top example shows a case with moderate variability of scores within each group. The second situation shows the high variability case. the third shows the case with low variability. Clearly, we would conclude that the two groups appear most different or distinct in the bottom or low-variability case. Why? Because there is relatively little overlap between the two bell-shaped curves. In the high variability case, the group difference appears least striking because the two bell-shaped distributions overlap so much. In the case of Nkoma, the post – test results of Group 2 had a mean of 31.25 and standard deviation of 8.56; the variability was less than that of the pre-test (sd 17.51). Group 1 of the same school posted a relatively high mean of 41.25 in the post-test, with a standard deviation of 12.99. There was a higher variability in Group 1 compared to Group 2. For Mbale SS, Group 2 posted a mean of 45 with a standard deviation of 14.62 while Mbale High school had a mean of 40.67 and a standard deviation of 18.79, indicating the highest variance.

Table 4: Variance and the positive student t values (extracted from Table 1B in the Appendix)

Combined Groups	Difference between means	Standard error of the mean	Computed t statistic	$t_{0.01}$	$t_{0.05}$	$t_{0.1}$
				2.787	2.06	1.708
1. MBALE SS AND MBALE COMPREHENSIVE HIGH	9.75	3.99	2.44	Accept	Reject	Reject
2. MBALE SS AND OXFORD HIGH SCHOOL	6.08	4.46	1.36	Accept	Accept	Accept

3. MBALE SS AND MBALE HIGH SCHOOL	9.42	5.44	1.73	Accept	Accept	Reject
4. MBALE SS AND BUGISU HIGH SCHOOL	4.08	3.42	1.19	Accept	Accept	Accept

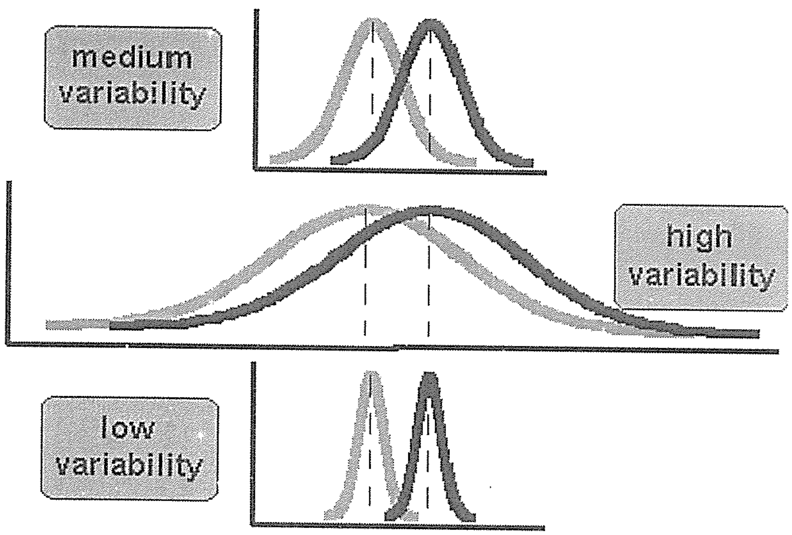

Figure 2. Three scenarios for differences between means.

This leads us to one very important result: when we are looking at the differences between scores for two groups, we have to judge the difference between their means relative to the spread or variability of their scores. The t-test does just this.

Statistical Analysis of the t-test

The formula for the t-test is a ratio. The top part of the ratio is just the difference between the two means or averages. The bottom part is a measure of the variability or dispersion of the scores. This formula is essentially another example of the signal-to-noise-metaphor in research: the difference between the means is the signal that, in this case, was introduced into the data; the bottom part of the formula is a measure of variability that is essentially noise that may make it harder to see the group difference. For instance, from Table 4 above, the difference between the means of Mbale SS and Comprehensive High School is 9.75 with a standard error of this difference being 3.99, whereas in the case of Mbale SS and Oxford High School the corresponding figures are 6.08 and 4.46 respectively. We reject the null hypothesis in the first case and accept it in the latter at $p < 0.05$. Figure 3 shows the formula for the t-test and how the numerator and denominator are related to the distributions. Rejecting the null hypothesis does not necessarily mean it is invalid. It may mean that there are more experiments that should be conducted. It may also mean that the sample sizes may have to be increased in order to get the desired result.

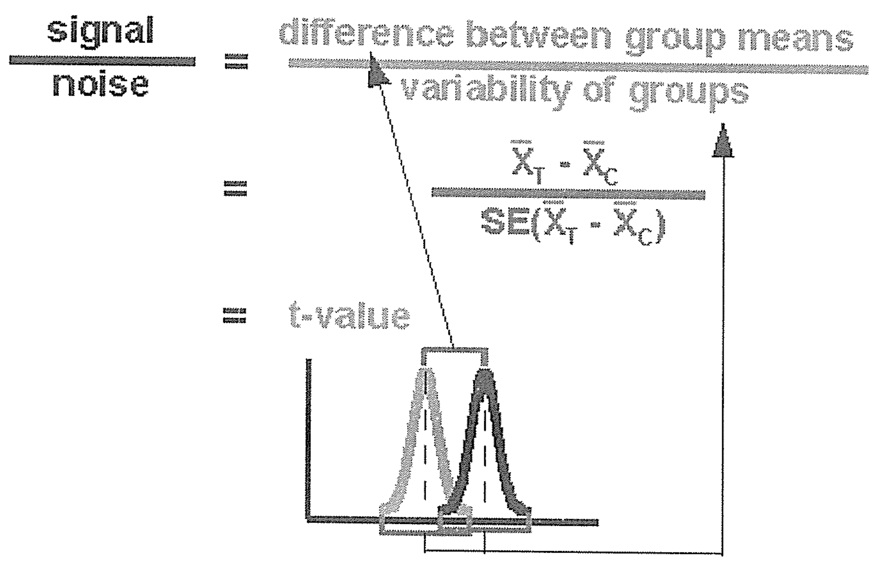

Figure 3. Formula for the t-test.

The top part of the formula is easy to compute -- just find the difference between the means. The bottom part is called the standard error of the difference. To compute it, we take the variance for each group and divide it by the number of people in that group.

We add these two values and then take their square root. The specific formula is given in chapter 3.

Validity and Reliability of findings

Internal validity

Internal validity is high when differences between groups could be attributed to the treatment, thus ruling out rival hypotheses attributing effects to extraneous variables (Borg et al, 1993). The extraneous variables that were identified include:

Extra information – the depth and width of the content on the internet may not have been the same as that in the textbooks, or tailored to the national curriculum. The teachers hand was evident in mitigating this by making premeditated choices of the material to be studied.

Attrition – no experimental mortality was suffered.

Environmental effects - the teaching-learning exercise was carried out in the morning for some groups and in the afternoon for others. How far this could have affected results was not certain.

Pre-test – this almost always affects the results of the post –test. The question is could the pre-test in this exercise have affected one group more adversely than the other? There seemed to be no evidence.

The quest for high internal validity orients researchers to design experiments in which treatment manipulations can be tightly controlled. Consequently, using naturalistic conditions such as real classrooms was avoided given the many extraneous sources of variance that were likely to operate in those contexts. Educational technology researchers are interested in the interaction of medium and method (Kozma, 1991, 1994; Ullmer, 1994). Realistic media applications rather than artificial ones need to be established.

External Validity

The findings can be generalized to other schools of Mbale district in the different circumstances and environments of their settings. In other words, external validity becomes as important a concern as internal validity.

Reliability

Reliability or precision refers to the ability to repeatedly get the same result with the same instrument, regardless of the assessor. This result may not necessarily reflect the true mean, but it is consistent The experiment of assessing and determining the method that is superior, as detailed out in the write –up, can be repeated with a high degree of consistence of results.

CHAPTER 5

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The research hoped to address the following questions:

Are the teachers competent in the use of ICT in educational practice?

Do schools have the ICT components in their budgets?

Are schools adequately equipped with ICT materials?

What is the level of usage of the available equipment?

What is the effect of the use of ICT on the attainment targets in secondary education?

General perspective

It started in the early eighties of the twenties century. Computers are entering schools. Although the computer and ideas to support innovative uses are present, there is a lag in educators' understanding of computers and how they relate to learning and thinking. The problem is an educational one: What do educators, who want to use ICT, need to know and how can they acquire this knowledge? Educators might question:

Where to use computers?

What computers to buy?

What new hardware and software equipment are needed?

How many computers are needed?

Where are trainers with ICT expertise?

These questions can be answered in various ways. However the answers don't lead us to the very source of the matter. They obscure far deeper issues. The use of computers in education is related to the view on how students learn and the role of the educator in that process. We have to consider the use of the computer in relation to all kinds of educational software and hardware, as people did in the eighties, and talk about:

Computer based Training (CBT)

Computer based Instruction (CBI)

Computer Assisted Instruction (CAI)

Computer Assisted Learning (CAL)

Computer Supported Instruction (CSI)

Computer Managed Instruction (CMI)

But all the underpinning approaches of these terms take the computer as a starting point in thinking about the use of ICT in education. They refer to the old educational paradigm of instruction – memorize – testing.

It has been sufficiently proven in the past that, in spite of the attractive features of technological devices, an exclusive technology-driven approach towards learning creates disappointing results (Dillemans, 1997). In order to bring about genuine innovation, the implementation of technologies needs to be accompanied by a change in the educational goals. One main reason for the gap between the potential power of a given technology and its effects on the users is the incompatibility between these new environments and users such as learners, teachers, parents and educators. The challenge to teaching and learning is to transform available information technologies into learning technologies. If we try to do so, it appears that the educational paradigm evolutes to interaction – production – reflection – revision. This reflects a constructionist view on teaching and learning. Both learner and teacher have a personal learning instrument at their disposal: the computer. From this point of view it is very important for people to think about the role they play and the explicit and implicit assumptions they make within the learning environment. In this view literacy means to be aware that each environment or system carries with it many underpinning assumptions (Solomon, 1986). This hits the very source of the matter: talking about teaching and learning and the functionality of the use of information and communication technology (ICT) in the learning process. Teaching and learning is about interaction between students and educators, at the same place and the same time (asynchronous); but time and place does not matter any more. A conversational framework (Laurillard, 1993) is a way of capturing the essentially iterative, communication and goal-oriented actions with feedback that are necessary to complete the learning process. The learning process operates on the two levels of discussion of theory and experienced practice, linked by processes of adaptation and reflection. The framework illustrated here describes the process operating at the level of a concept or skill, such as a topic within a particular stage of the curriculum

Conversational Framework for the learning process

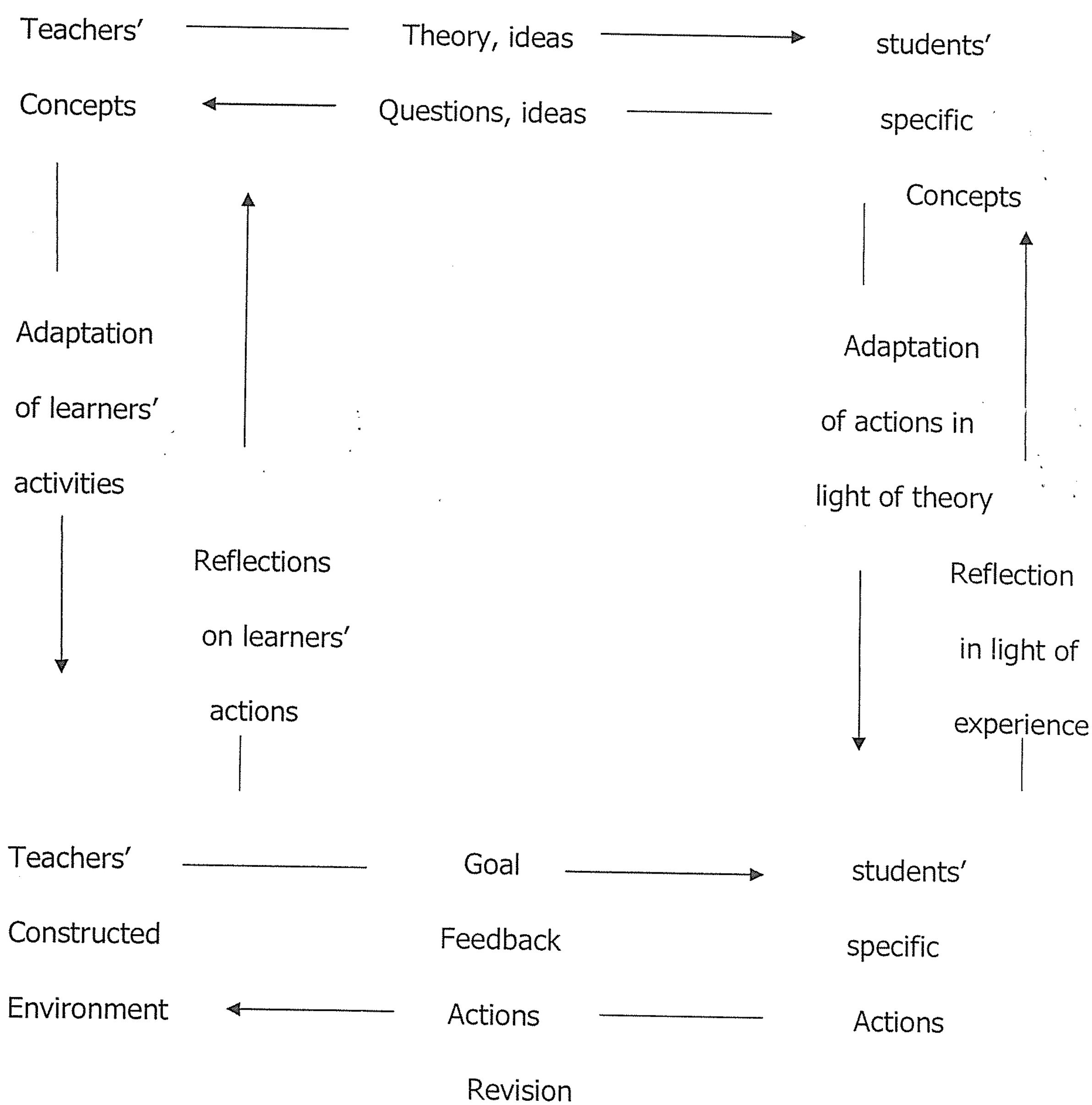

Figure 4: *Conversational Framework*

Fogarty (1999) summarizes the constructivist bricks of a learning environment in seven terms: real live and learner based, rich, social interactive, differential, explorative and experimental, interventional (by an expert), meta-cognitive and reflective. We need to look at what the use of the computer can offer in learning environments and what the educator and learner need to know to act with this personal learning instrument in a constructivist way. Laurillard (1993) summarized what the top priority issues are in mainstreaming learning technologies for practice, policy, and partnership:

Practice: Supported active learning, Academic time

Policy: Investment, Reward structure

Partnership: Complementary roles, Shared resources

Teacher Competence in the use of ICT in educational practice

Artisans at times learn their trade by working closely with an experienced individual and through apprenticeship they are able to gain some knowledge. According to the findings in this study at least 83% of the teachers did not have the skills to integrate ICT – Methodology in the teaching- learning process. They did not feel they needed to invest in this venture as 72.85% expected to learn by infection.

In the early 2000s, the Uganda National Curriculum Development Centre (NCDC), worked with the International Development Research Centre (IDRC) and came up with the CurriculumNet project to develop, test and implement a mechanism for curriculum integration and delivery for primary and secondary schools in Uganda via communication networks and using computer equipment. In keeping with the mandate of NCDC and its functions, the CurriculumNet Project was conceived to influence both the practice and policy of Education. Whereas these initiatives had made tremendous strides in school connectivity, teacher training and promotion of global learning, none attempted to develop online content, to supplement the current learning system in Uganda. The ultimate goal of this project was to accelerate the participation of schools, teachers and learners in the use of ICT in the teaching and learning process. As an action research activity, it was intended to test the technical and operational feasibility, and economic viability of Information and Communication Technologies (ICTs) in the education delivery process. It was also expected to examine the "value added" by ICTs in core subject areas of the educational system in Uganda and the extent to which teaching and learning is enhanced. Almost 10 years later (in 2011) the CurriculumNet project is still crawling and is now retooling one teacher per school. This program suffered from a lack of funding.

ICT-skills partly necessary for using ICT in education.

Looking at the afore mentioned research results, it seems unnecessary to argue for specific ICT-skills for teachers as a key for the problems experienced by the implementation of ICT in education. How to implement ICT in education mainly seems to be a design-problem (how does a teacher create a powerful learning environment?)

Required competences for solving this problem are defined within the concept of core problems. Core problems can be defined as the central problems and dilemmas in professional practice as regularly encountered by professionals and thus characteristic of the profession (Onstenk, 1997). Core problems are an interesting basis for education, because they define the professional core and structure and select the professional content. The professional, as an acting individual, is positioned in the centre.

In this study 82.8% of the teachers admitted that they needed in-service training before they apply ICT in the teaching-learning process. Approximately 88.5% felt ICT enhances the retention capacity of learners. Some teachers (21.44%) thought ICT use does not bring significant benefits. On a wider European level, the Eurobarometer Benchmarking survey revealed that the vast majority of European teachers saw the advantages of ICT use in school and especially for letting pupils do exercises and practice (80%). A very high 86% stated that pupils are more motivated and attentive when computers and the Internet are used in class. However, in some countries there was a substantial number of teachers (overall 1/5 of European teachers), who denied that there was much of a pedagogical advantage of computer use in class (Empirica, 2006).

Guiding learning processes can be mentioned as one of the core problems of future education. One of the dilemmas the teacher has to cope with is whether they should 'direct' students learning processes or 'leave students at their own devices'. A student has to work as independently as possible, but when should a teacher intervene? And in what way can a student accomplish the best (independent) learning activity? How should the teaching- learning process be designed to foster the best learning achievements? The teacher has to constantly consider which teaching aids or materials are most suitable to use. Other dilemmas will arise. For example, how much a teacher has to know about each ICT application (to be aware that the application is available or to know how to use it). Another dilemma concerns the question whether the teacher develops the teaching material himself or lets someone else do it for him.

A teacher requires many educational and didactical skills to deal with these questions adequately (Ministerie OC&W, 1998). In fundamental terms, it involves several aspects:

A great pedagogical, didactical and educational psychological craftsmanship. To be a professional on the subject matter .

A large knowledge of (the application possibilities of) modern educational tools.

Skilled in downsizing student guiding processes (e.g., formulating assignments, structuring the guiding processes and assessment.)

The new learning environment differs from the one we are familiar with; the teacher has to cope with many more uncertainties. A curriculum in which lessons and content are fixed no longer exists. As a result, the teacher has to keep organizing his work. Moreover, the teacher cannot create new learning environments completely and independently. He has to depend on all kinds of things like the technical infrastructure, timetables and the activities of other teachers. In doing so, the teacher looses a part of his autonomy (another core problem) and therefore, he is forced to collaborate with his colleagues in a way entirely different from what he was used to. It requires skills such as:

Creativity

Flexibility

Logistic skills (e.g. for assigning work- and study places and grouping students)

Skills for working in projects

Administrative and organizational skills

Collaborating skills.

Furthermore, the interviewed teachers especially underline the teachers' attitude concerning the use of ICT in education. New things are intimidating and are causing resistance. The teachers point out a 'professional attitude'. Important features of this attitude include being ready for innovations in general and for ICT in particular (Voogt en Odenthal, 1998).

ICT Budget Provision

The budgeting processes in the six schools did not differentiate between the teaching of computer studies, a subject, and the ICT- integrated teaching-learning process. The latter cuts across all subjects. Items on the budgets that merited consideration were those used in the teaching of the traditional sciences: Chemistry, Physics, Biology and Agriculture. Most of these instructional materials were made available especially to candidate classes and in their final term. Support for computer studies included hardware repairs, procurement of memory backup chips and printing paper. All these did not take more than 8% of the annual indicative school budget figure. Approximately 92.8% of the teachers believed the key to improved use of ICT in the teaching learning process was by including it on the school budget. However, 31.4% of the teachers said their head teachers were not keen on the use of ICT. This is the beginning point of the lack of initiative and support.

ICT Equipment in Schools

The 40 monitor units, 4 processors, 1 LCD projector and a printer for each ICT school were hardly the minimum one would recommend for these schools. There was no provision for teachers' ICT preparations. Rooms that were set aside for this were instead used for keeping some equipment. The range of facilities for ICT-integrated instruction was inadequate. For instance there were no cassette radios for language instruction, recorders for tailored school – level teaching and recording of programs on national TVs. There were no websites uploaded with teacher-organized content, for the benefit of the learner even during holidays. Nor were there tele-collaborative arrangements for consultation and sharing of knowledge and experience. Continuous assessment is necessary for student attainment. Students can go through self – administered testing when they have academic work already arranged for them on school computers or as an online facility. Portable modems are now cheap and easily available in computer stores. Schools would do well if they provided each department with one portable modem and a memory chip.

Accessibility

Accessibility to ICT equipment concerns both the teacher and student. One of the non-ICT schools had attempted to set up a computer room with 10 PCs. Unfortunately the computer room was at the same time a staffroom. Students could not easily access the computers out of respect for the teachers. In ICT schools, computer studies were always taught in the computer room. The teaching of computer studies should take place in the computer room if there is practical work necessitating a computer. Occupying the computer room all the time denies students other learning opportunities. One or two computers should be placed either in the staffroom or a room adjacent to it, to provide opportunity for teachers to download and upload content, let alone prepare for their lessons. Departmental rooms exist in some schools and these too can be used as access points to the vast online resources.

Effect of ICT – Integrated Methodology on Attainment.

From Table 2, chapter 4, the difference between the means of the ICT and non - ICT Groups was not significant at given critical values and significant at certain values. There were more cases where we would conclude that the difference between the means was not significant.

Software can ensure that learners are given tasks at an appropriate level that can be matched to their prior or their individual needs (Lynch, Fawcett and Nicolson, 2000)

Overall, evidence from the studies reviewed shows that attainment improves as a result of embedding ICT into teaching and learning. However, it was a common observation that there is a difficulty to quantify the extent of the improvement or the causal chain that links e-learning to improved outcomes. Inferring a causal relationship between ICT and pupil achievements from simple correlations can be misleading. It has to be considered that many unobserved factors may influence better learning results in national tests. According to the study 'Innovative Learning Environments for School' many variables and not ICT alone influence a learning situation or a learning environment'. Factors such as local school strategies, the school management's style, and parents' attitude combined with the strategic use of ICT may lead to a paradigm shift in learning. It can be assumed, that schools with more motivated teachers and head teachers are more likely to adopt ICT and to produce better attainments. If these factors are not taken into consideration, the findings might be deceptive. Isolating the impact of just one factor, such as ICT, therefore requires a well-considered approach. Furthermore, although assessing changes in learning outcomes and processes are important approaches to evaluating educational impact, it is also important to recognize that characteristics of the students, the technology, and the interaction between students and technology may influence its effectiveness. Moreover, socio –economic context has been proven a decisive variable determining student outcomes. Characteristics of the learner include motivation, ability, and prior knowledge of (or experience in) the domain. In particular, the background knowledge of the learner has been repeatedly in the studies identified as a critical predictor in learning performance. Differences in students' prior knowledge or experiences have been found to change the usefulness of different resources and to result in different learning outcomes. Finding ways to assess and to account for student experience or knowledge is crucial to developing valid assessment of educational technology.

Other forms of intervention

Other forms of educational interventions such as peer tutoring, reciprocal teaching and homework, for example, all produce greater average impact (Hattie, 1987; Hattie, 1992). In a study of the effect of different types of study skills interventions, the average effect size was 0.57 (Hattie, Biggs and Purdie, 1996); this would move a class from 50^{th} to the top 30. A study of the effect of thinking skills or meta-cognitive approaches (Marzano, 1998) indicates the average impact would move a class from 50^{th} to the top 20 (an effect size of 0.72).

Conclusion

Research indicates that ICT can make a difference to student learning. In large studies there is a positive link between the provision or use of ICT resources and student attainment, but this link is weak. Analysis of targeted interventions using ICT shows a more positive picture, but not as effective as other educational innovations. More substantial gains in student attainment are achievable where the use of ICT is planned, structured and integrated. The way that these equipment and resources are used by students and teachers is what makes the difference. Other options to improve student learning and attainment should be explored. Providing ICT equipment to schools or teachers will not necessarily make a difference. In terms of attainment resulting from ICT supported teaching and learning, this study has proved what other researchers found that ICT on its own brings little benefit. It can be productive if used in conjunction with other approaches, methodologies and interventions. Teachers are less equipped with the requisite skills for an ICT – integrated teaching and learning strategy. This partly explains the low usage and application of ICT in Ugandan schools today. Teacher training colleges have perhaps not spearheaded the initiative. School budgets are drawn without any meaningful consideration for the ICT components; this is not helped by the apparent lack of interest from some head teachers.

Recommendations

Policy makers (national, regional and school level)

1. Plan for transformation and for ICT.

Support the transformation process and management of change, of which ICT is an enabler and amplifier. The key word is transformation. If the organizational and institutional context does not support new working methods, educational practices will not change. Taking into account that most teachers embrace new technologies in a step by step process, systematically but slowly, any change should be supplemented by process management and connected to realistic visions.

2. Include new competencies in the curricula and in assessment schemes.

Most of the reviewed studies show that ICT impacts on competency development, specifically team work, independent learning and higher order thinking skills –

that are not yet recognised by many education systems. These competencies should be formally included in the curricula and ways of assessing them explored. They are important outcomes of a new and changed educational context.

3. **Implement new forms of continuous professional development in a workplace environment and as part of a culture of lifelong and peer learning.**

New approaches to teacher training should be much more related to the concept of lifelong learning, knowledge sharing and peer learning. To be confident, teachers must be able to upgrade their ICT skills and gain more pedagogical knowledge. Teachers have to become active shapers of their own learning process which requires a professional environment and culture that allows teachers to do so. An experimental approach using ICT in everyday practice is an important factor in increasing teachers' pedagogical competence. Training programmes should be more school-based and adapted to the particular needs of teachers and fit to personal and subject specific needs, or project related needs. Continuous professional development should be in the foreground enabling teachers to learn how to upgrade their skills. Up-front sessions should be replaced by practice oriented projects in the practical working environment. Initial teacher training for ICT and in - service training should be given priority.

4. **Build up a clear political will and invest in ICT consolidation**

The evidence showing that ICT impacts most with e-mature schools and teachers suggests that there is a takeoff or tipping point in ICT use. Before that point, little change appears to be happening and investments seem to have little pay-off. Once the change occurs the benefits accrue. Work towards ensuring the majority of schools (80 per cent by 2014 for example), not just the early adopters, reach the point of e-maturity. One way forward is to make use of the existing potential of e-confident users(students, teachers, head teachers, ICT support) in and around schools (parents, community centres, librarians).

A second important issue for ICT consolidation is the focus on content and support services in schools. The value of access to good interactive digital content is essential for the successful implementation of ICT.

5. Motivate and reward teachers to use ICT

In addition to access to infrastructure and content and having the requisite skills, teachers' motivation is a critical factor in ICT adoption, and this is often neglected. Actions should be built into policies that encourage teachers to use ICT more – and more effectively. Policies in this area should include measures raising the confidence levels of teachers (sufficient on-site support, appropriate in-service and initial teacher training in ICT) but also means of recognizing and rewarding the use of ICT (such as appraisal schemes, making good ICT use part of career paths, or time benefits for teachers engaged in ICT related projects).

6. Integrate the ICT strategy into the school's overall strategies

Evidence confirms that teachers who experience a more positive impact of ICT are most likely to be found in schools where head teachers have used ICT to support the development of the school's values and goals. If the ICT strategy is integrated into the school's overall strategy ICT has the greatest potential to act as a catalyst for change. Furthermore this overall strategy needs to be developed and evaluated by all school actors and not only by the head teacher in collaboration with the ICT teacher, thus establishing a culture of collaboration and commitment and making it more likely that the policy is actually solving a problem that teachers and students are facing.

7. **Transform positive attitudes towards ICT into efficient widespread practice**

Schools should capitalise on positive attitudes. To achieve greater impact it is important that teachers underpin ICT use with a pedagogical approach. There seems to be a mismatch between the potential of ICT for learning and the actual teaching approach of teachers. The majority of teachers think that ICT can improve learning outcomes, but they think that ICT has little or no impact on their methodology. This could be achieved by hands - on practical training, providing
easy to use ICT based materials, peer learning and peer sharing of experiences,

Research and Development

8. **Consider context-sensitive and process- oriented research methods**

In such a complex field as education and pedagogy, qualitative methods are necessary to investigate impacts. There is a need to go beyond pure observations and evaluate more concretely school contexts, learning situations and teaching processes to show under which circumstances ICT based activities can enhance learning and improve skills. This requires some degree of qualitative interpretation, in order to evaluate the causes of impact which have been observed. A holistic approach to identify impact is needed. What works for whom in what circumstances is what policy makers/ shapers need to know.
Apart from research that shows benefit for ICT in subject, research should be conducted to find out how ICT can positively influence the learning process. How ICT can support certain learning processes and thus raise attainment will require a process oriented approach in evaluating impact of ICT for the future. Further research is needed into detecting the impact of ICT on these wider competencies and innovative pedagogical practices behind them.

9. **Create closer links between research and practice**

More fundamental research, small scale, focussed research on specific ICT tools should be combined with research which is much more closely linked to practice: Ways forward are to develop a critical and reflective attitude amongst teachers or teachers carrying out research themselves (coached by researchers) and involving schools in defining research questions.

Furthermore the results of research should be made available to practitioners in a way that it is useful for them (evidence leaflets, easy access to research evidence and appropriate ways of communicating main research findings).

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APPENDICES

KAMPALA INTERNATIONAL UNIVERSITY
EXPLORING THE HEIGHTS

Ggaba Road - Kansanga
P.O. Box 20000, Kampala, Uganda
Tel: +256- 41- 266813 / +256- 41-267634
Fax: +256- 41- 501974
E- mail: admin@kiu.ac.ug,
Website: www.kiu.ac.ug

OFFICE OF THE COORDINATOR, EDUCATION
SCHOOL OF POSTGRADUATE STUDIES AND RESEARCH (SPGSR)

January 27, 2011

Dear Sir/Madam,

Request granted

RE: REQUEST FOR SENTALO ALEX MED/20039/82/DU TO CONDUCT RESEARCH IN YOUR ORGANIZATION

MBALE SEC. SCHOOL
DEPUTY HEADMASTER
0 9 SEP 2011
BOX 98 MBALE

The above mentioned is a bonafide student of Kampala International University pursuing a Master of Educational Management and Administration. He is currently conducting a field research of which the title is **"ICT and the teaching -Learning Process, Mbale District Uganda"** as part of his research work, he has to collect relevant information through questionnaires, interviews and other relevant reading materials.

Your organization has been identified as a valuable source of information pertaining to his thesis. The purpose of this letter is to request you to avail him with the pertinent information he may need.

Any information shared with him will be used for academic purposes only, rest assured the data you provide shall be treated with utmost confidentiality.

Any assistance rendered to him will be highly appreciated.

Yours truly,

Mrs. Ivy Njeru
Coordinator, Education (SPGSR)

KAMPALA INTERNATIONAL UNIVERSITY
SCHOOL OF POSTGRADUATE STUDIES
P.O. BOX 20000, KAMPALA

KAMPALA INTERNATIONAL UNIVERSITY
EXPLORING THE HEIGHTS

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Yours truly,

Mrs. Ivy Njeru
Coordinator, Education (SPGSR)

KAMPALA INTERNATIONAL UNIVERSITY SCHOOL OF POST GRADUATE STUDIES P.O. BOX 20000, KAMPALA

This is to confirm and Bear witness that the bearer of his letter visited our School on 16th.06-2011 and carried out his research successfully
09.09.2011

KAMPALA
INTERNATIONAL
UNIVERSITY
EXPLORING THE HEIGHTS

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SCHOOL OF POSTGRADUATE STUDIES AND RESEARCH (SPGSR)

January 27, 2011

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Yours truly,

[signature]
Mrs. Ivy Njeru
Coordinator, Education (SPGSR)

KAMPALA INTERNATIONAL UNIVERSITY
SCHOOL OF POST GRADUATE STUDIES
P.O. BOX 20000, KAMPALA

Comment:
Mr. Sentalo was received on 14/6/2011 and he was given opportunity to work with our member of staff, Mr. Opio Walter; to collect data and teach the two groups of students. This is therefore, to certify that the data collection process at Nkoma was well done.

HEADTEACHER
NKOMA SECONDARY SCHOOL
P. O. Box 513, MBALE
Date 09/9/011 Sign .... Dr. Nambale Moses D/HT 09/9/2011

KAMPALA INTERNATIONAL UNIVERSITY

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OFFICE OF THE COORDINATOR, EDUCATION
SCHOOL OF POSTGRADUATE STUDIES AND RESEARCH (SPGSR)

January 27, 2011

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Yours truly,

Mrs. Ivy Njeru
Coordinator, Education (SPGSR)

KAMPALA INTERNATIONAL UNIVERSITY SCHOOL OF POST GRADUATE STUDIES P.O. BOX 20000, KAMPALA

This is to confirm that Mr SENTALO ALEX carried his research work in our institution on 16/06/2011

OXFORD HIGH SCHOOL P.O. BOX 2034 MBALE DEPUTY

09/09/2011.

KAMPALA INTERNATIONAL UNIVERSITY
EXPLORING THE HEIGHTS

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SCHOOL OF POSTGRADUATE STUDIES AND RESEARCH (SPGSR)

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Any assistance rendered to him will be highly appreciated.

Yours truly,

Mrs. Ivy Njeru
Coordinator, Education (SPGSR)

KAMPALA INTERNATIONAL UNIVERSITY
SCHOOL OF POST GRADUATE STUDIES
P.O. BOX 20000, KAMPALA

This is to certify that Mr Sentalo Alex carried out his research work at Mbale H.S on 17th June-2011.

MASSA JOHN
DEPUTY HEADMASTER
MBALE HIGH SCHOOL.

MBALE HIGH SCHOOL
STAFF LIST TERM ~~TWO, 2010~~
ONE 2011

NO	TEACHER(MALE)	SUBJECT TAUGHT	MOBILE NO.
1	MR. WAMBEDE H. AMIDU	HEADMASTER	0782372463
2	MR. MASSA JOHN	DEPUTY 2 MATH S.5,S.6	0772398454
3	MR. MUDUMBA GEORGE	D.O.S CHEM S.3A,C	0772661767
4	MR. WEBOYA N. HERBERT	ASST. D.O.S CRE S.5,S.6	0782652532
5	MR. WAKWAALE TITUS	CRE S.5(P.1)	0782312322
6	MR. MADETE RICHARD	COMMERCE/ACCOUNTS S.4	0751388258
7	MR. HASAHYA MUSA	CORDINATOR DOUBLE SHIFT IRE S.5,6	0782892150
8	MR.ISABIRYE AHMED	HISTORY S.5,S.6,S.4A,B,C,D	0773239062
9	MR. MBOJJA GEOFFREY	BIO/CHEM S.5,S.6	0774397652
10	MR. SATYA LAWRENCE	GEOG. S.5,S.6 (P.3)	0782329895
11	MR. GUDOI ALEX	PHY/CHEM	0713476805
12	MR. SIMIYU LEONARD	FINE ART S.4A,B,C,D S.6,S.5	0752/0776884845
13	MR. MAKOKHA NICHOLAS	CHEM S.4A,B,C,D	0774631304
14	MR. OKWALANGA CHARLES	AGRICULTURE S.5,S.6	0774904755
15	MR. OBOTH ALOYSIUS	CRE S.5,S.6	0754680813
16	MR. KIBUUKA LAWRENCE	GEOG/G.P S.5,S.6	0775402022
17	MR. BWAYO PERES W.	ENG S.4A,B,C	0776046648
18	MR. WOGIBI G. FRED	CHEM/BIO S.2A,B,C,D	0782968683
19	MR. SHISA STEPHEN	CRE/GEO S.4A,B,C,D	0784468040
20	MR.OMUSE STEPHEN	COMMERCE S.2A,B,C,D	0774755527
21	MR. WAMBALO STEPHEN	GEOG S.5,S.6	0762436805
22	MR. WABUTWA MARTIN	MATHS S.4A,B,C	0752610956
23	MR. OKURUT SHABAN	BIOL	0772594530
24	MR.OBUA RICHARD	GEOG S.5,S.6(P.1 & P.2)	0772380916
25	MR. WANAMBWA MUSA	HIST S.6 P.E S.1A,B,C,D	0782745047
26	MR. MAWA FRED	ECONOMICS S.5,S.6	0782515294
27	MR. NAKISA BENARD	HISTORY S.6	0772350027
28	MR. WAMBEDE ISSA	CRE IRE S.5,S.6 1C,D,S2B	0782660013
29	MR. NGUNI JAMES	KISWAHILI S.5,S.6	07821 1981
30	MR. MUDE JAMES	MATH S.2A,B,C,D	0782337788
31	MR. MALINGA JOSEPH	ECONOMICS S.5,S.6	0772937672
32	MR. WANYAMA DAVID	HIST/GEO S.2A,B,C S.5,S.6	0782439276
33	MR. OKURUT OKIRIA DAVID. R.	AGRIC S.5,S.6,S.2A,B,S.4A,B	0782065881
34	MR. KAKUNGULU KASSIM	MATH S.2C,S.5,S.6	0775533680
35	MR. CHEMUTAI M. EDDY	MATH S.3A,B,C,D	0774928296
36	MR. FARJALLA U. YAHAYA	IRE 1A,B,2A,C,3A,B S.5,S.6	0782821424
37	MR.OBBO GODFREY	ENGLISH/LIT S.3C,S.6	0752/0776811271
38	MR.WANYERA MARTIN	CRE S.2A,B,C,D	0782458644
39	MR.~~HIGENYI AMUZA~~ MAGOMU ISAAC	PHY/MATH	0772 3906414
40	MR.EDUFUK DAVID	PHY/CHEM S.5,S.6 S.4B,S.3B	0752994112
41	MR.WASUKIRA CHARLES	BIO S.3A,B,C,D	0782960732
42	MR.NABUGODI EDWARD	BIO/CHEM S.4B,4D,S.5	0792881987
43	MR.MUBAKYE GEORGE	COMM/ENT S.2A,B,C,D S.5,S.6	0776931513
44	MR.ORUTE ANDREW	CHEM S.3A,B,C,D	0781545906
45	MR.OKALABO	PHY P2 S.5,S.6	
46	MR.OPOI FREDRICK	GEO/ PHY EDUC A,B,C,D	0782396989
47	MR.WASHIREKHO WETAYA	HIST/CRE S.1A, 1B	
48	MR LAASI HUMPHREY	COMMERCE, ENT	0774911477
	MS GIMONO ROSEMARY	AGRIC	
	MS NAMBUYA BARBRA	GEO/EC	
	MS NAMBUYA SUSAN	BIO/CHE	
	MR. WANAKINA MASIGA	AGRIC	

MASANI REHEMA IRE 0782 278563

ATIM JAQUELINE ENG 0772686866

NAMBUYA BARBARA GEO, CRE

FEMALE TEACHERS

	MRS WAMBOGA K. JOY	DEPUTY HEADTEACHER	0782503267
1	MRS KAMULEGEYA FARIDA	ENGLISH S.4C, D, LIT. S.5	0772551747
2	MISS AMONG ROSEMARY	CRES.1A,B,C,D.	0782087860
3	MISS ATIMANG CHRISTINE	GEOG S 1A,B,C,D	0712941525
4	MISS LUNYOLO ANNET	BIO/CHEM	0782455157
5	~~MISS MUTAMBO ANNET~~	~~ENG S.1A,B,C,D~~	~~0772463713~~
6	MISS NAMAROME HARRIET	HISTORY S.1A,B,C,D	0782957938
7	~~MISS NAMUKHURA SOPHIA~~	~~AGRIC S.3A,B,C,4A,B,C,D~~	~~0782699168~~
8	MISS NAMUKASA MARION	ENGLISH S.2A,B,C,D	0702492718
9	MISS [illegible]	~~BIOLOGY/CHEM 1A,B,C,D~~	~~0782959808~~ 0752414020
10	MISS MUGIDE SAFINA	COMM/ENT S.5, S.1A,B,C,D	0782499655
11	MISS MUGIDE IRENE	FINE ART S.4A,B,C,S.5	0782488724
12	MISS BUWULE PHOEBE	GEOG 3A,B,C,D	0772910116
13	MISS MUYAMA CAROLINE	ENGLISH	0772394395
14	MISS CHESANG JUSTINE	AGRICULTURE S.1A,B,C,D	0752991136
15	MISS NASIYO SARAH	GEOGRAPHY 3A,B,C,D	0751559255
16	MISS WATAKA HALIMA	CRE 3A,B,C,D	0782085051
17	MISS AMONGIN RUTH	ENGLISH 3A,B	0777771253
18	~~MISS NAMUKOSE LILIAN~~	MATHEMATICS	0776247086
19	MISS MUTONYI REBECCA	HISTORY 3A,B,C,D	0772553867
20	MISS NAMUGAYA JALILA	PHYSICS S.5,S.6	0774781380
21	~~MISS NAMUTOSI STELLA~~	~~ENGLISH S.5,S.6~~	
22	MISS KAKAYI JULIET	MATH S.1A,B,C,D	0774335341
23	MISS NAMULUNDA GRACE	ECON	0774769205

NON-TEACHING STAFF

1	MR WANDUKWA EZRA	BURSAR	0782624798
2	MISS AKUMU SOOVIA	ASS BURSAR/STOREKEEPER	0754831656
3	MISS NAMUSANGO TEDDY	SECRETARY	0774152825
4	MISS NALYANA DEBORAH	LIBRARIAN	0774814313
5	MR. KITUTU ERIZAFAN	LAB TECHN	
6	MR. WAMAKIYA CASSY	LAB TECH	0752329095
7	MR WAMUKOTA JACKSON	WATCHMAN	0753291710
8	MR WAKOBA MILTON	COOK	
9	~~NELIMA ANNA~~ WAKAYI-IF MOSES	~~COOK~~ CLEANER	0791538497
10	MR. WELISHE DAVID	GROUNDSMAN	
11	MR. WERISHE FRED.	JANITOR	0784534595
12	MR. WADADAYA HUSSEIN	WATCHMAN	0772023520
13	WAKWALE JAMES	CLEANER	
14	MR. MUDEBO ASUMAN	SWEEPER CLEANER	
15	MR. NABUYOBO EDRISA	DRIVER	
16	MUSIKA MICHEAL	GROUNDMAN	
15	KIGERE JANAT SARAH	COMPUTER TEACHER	0774918762
17	MISS NAMARYE SAFINA	ASST BURSAR/STOREKEEPER	0704505674

HEADS OF DEPAERTMENTS 2010

1	MR. SONGOW. EDMOND	PHYSICS
2	MR. MUDUMBA GEORGE	CHEMISTRY
3	MR. MBOJJA GEOFFREY	BIOLOGY
4	MRS. KAMULEGEYA FARIDA	ENG/LIT
5	MR MADETE RICHARD (MUBAKYE)	COMMERCE
6	MR. WEBOYA HERBERT N	CRE/DIV
7	MR. MAWA FRED	ECONOMICS
8	MR. NGUNI JAMES	KISWAHILI
9	MISS ~~NAMUKHURA SOPHIA~~	AGRICULTURE
10	MR. ISABIRYE AHMED	HIST
11	MR. ~~HASAHYA MUSA~~ WAMBEDE ISSA.	IRE
12	MR. MASSA JOHN	MATHS
13	MR. WAMBALO STEPHEN	GEOGRAPHY
14	MR. SIMIYU LEONARD	FINE ART
15	MR. WANAMBWA MUSA	PHYSICAL EDUCATION

SCHOOL COMMTTTEES

	PROCUREMENT COMMITTEE		**CONTRACTS COMMITTEE**
1	MR. MASSA JOHN(C/P)	1	MRS WAMBOGA JOY (C/P)
2	MR. WAKWAALE TITUS	2	MR WEBOYA HERBERT
3	MR. KIBUUKA LAWRENCE	3	MRS KAMULEGEYA FARIDA
4	MISS BUWULE PHOEBE	4	MR. OMUSE STEPHEN
5	MR. MUDUMBA GEORGE		MR. MUDUMBA. GEORGE.
	EVALUATION COMMITTEE		PHYSICAL EDUCATION AND SPORTS
1	MR. MADETE RICHARD	1	MR. WANAMWA MUSA
2	MR. MBOJJA GEOFREY	2	MR. SIMIYU LEONARD
3	MISS AMONGIN RUTH	3	MISS WATAKA HALIMA
4	MISS NAMUGAYA JALILA	4	MR OPOI FREDRICK
5	MR. MAKOKHA NICHOLAS		
	GUIDANCE AND COUNSELLING		ACADEMIC COMMITTEE
1	MRS. KAMULEGEYA FARIDA	1	MRS WAMBOGA K.J
2	MR. KIBUUKA LAWRENCE	2	MR MASSA JOHN
3	MR. MUDUMBA GEORGE	3	MR MUDUMBA GEORGE
		4	MR WEBOYA HERBERT
		5	MR WAKWAALE (ALL H.O.D)
	UNIFORM COMMITTEE		**DISCIPLINARY COMMITTEE**
1	MRS KAMULEGEYA FARIDA	1	MRS WAMBOGA JOY(CH.PERSON)
2	MISS NAMAROME HARRIET	2	MRS KAMULEGEYA F
3	MR HASAHYA MUSA	3	MR MADETE R.
		4	MR MASSA JOHN
1	TASK FORCE FOR FEES COLLECTION		EMERGENCY/DISASTER
1	MR. WAMBALO S.(CHAIRMAN)	1	MR. KIBUUKA L. (CHAIRMAN)
2	MR. WEBOYA H.	2	MR. MUDUMBA GEORGE
3	MR. ISABIRYE A.	3	MISS LUNYOLO ANNET
4	MISS NASIYO SARAH	4	MISS BUWULE PHOEBE

OXFORD HIGH SCHOOL- MBALE
P.O. BOX 2034
STAFF LIST 2010

Name of Teacher	D.OF Birth	Reg No	UTS No.	Qualification	Subjects	Load	Responsibility	Monthly Salary
MR. ODOI ALBERT	1973	GT/93/684		B.A ED, MED	HIST/ECON		H/M	90,000
MR. ONYANGO MARTIN LUTHER	1982	GT/2005/774	O/12939	B.A ED.	HIST/ECON	10	CLASS TEACHER	90,000
MISS. IKILAI FLORENCE	1983	V/2007/787	I/1433	DIP. ED	HIST/CRE	8	MATRON	160,000
MR. GESA ALI	1978	GT/01/036	G/169	B.A ED.	HIST/GEOG	12	CLASS TEACHER	80,000
MR. WADADA MIKE	1979	GT/06/2156	W/1307	DIP. ED, BED	ECON/HIST	20	CLASS MASTER	85,000
MISS. KAKAI JULIET	1983	V/2008/172	K/17648	DIP. ED	TECH. STUD	24	CLASS TEACHER	100,000
MR. WOTSOMU GODFREY	1972	GT/2007/2648	W/2016	DIP. ED,BED	HIST/CRE	12	CLASS TEACHER	80,000
MR. WAKUNYIRI JULIUS JOSEPH	1979	V/2003/300	W/2651	DIP. ED	MATH/PHY	8	CLASS TEACHER	80,000
MR. OMITTA CHARLES		V/99/1740		DIP. ED	BIOL/CHEM	8	CLASS TEACHER	80,000
MR. WOLIMBWA PETER	1984	V/2008/202		DIP. ED	ART& DESIGN	12	CLASS TEACHER	80,000
MR. NANGAI ROBERT	1982	GT/07/1986		B.A ED	ECON/HIST	8	CLASS TEACHER	80,000
MR. WANAMBWA MUSA	1983	GT/07/428	W/3608	B.A ED	HIST/ECON	15	H.O.D	115,000
MR. BUKOMA FELIX SAUL	1984	GT/07/2274	B/8988	B.A ED	ECON/GEOG	8	GAMES MASTER	90,000
MR. ERIKU JOHN STEPHEN	1985	V/07/720	E/2622	DIP. ED	ART& DESIGN	18	H.O.D	85,000
MR. WOGIBI FRED GIMEI	1976	V/06/489	W/3530	DIP. ED	BIOL/CHEM	12	H.O.D	80,000
MISS. ADIKIN RACHEAL	1984	GT/2008/2431	A/14746	B.A ED	ENG. LANG	22	CLASS TEACHER	80,000
MISS. KITUYI HARRIET				DIP. ED	AGRIC	8	CLASS TEACHER	80,000
MR. WAMUKOTA EMMANUEL	1958	V/86/543	W/1080	DIP. ED, BED	AGRIC	8	H.O.D	80,000
MR. OMOLLO EMMANUEL	1983			B.A ED	HIST/ECON	6	ASS. WARDEN	120,000
MR. TEBERE BENSON	1973			DIP. ED, BED	HIST/CRE	12	D.O.D	220,000
MR. IBOSERE MOSES OCHWO	1974			DIP. ED	HIST/GEOG	6	D/HM II	235,000
MR. ABDALLAH MUSA	1978			DIP. ED.	IRE/HIST	24	H.O.D	80,000
MR. NAPOKOLI ANDREW	1981			B. A. A, CCA	ICT/COMPT	24	H.O.D	80,000
MR. NZELEMA SIMON	1987			DIP. ED	ENG. LANG	4	CLASS TEACHER	80,000
MR. WAMBETE ROBERT				B.A ED	ECON/CRE	8	D/HM I	200,000
MRS. AMOLO JANE ROSE		GT/96/601		B.A ED	BIOL/CHEM	8	H.O.D	140,000
MR. MUGALYA DAVID MICHAEL	1975	V/20/076	M/9714	DIP. ED	ENG. LANG	18	H.O.D	100,000
MR. MAKULO STEPHEN				B.A ED	PHY/MATH	24	H.O.D	80,000
MR. AMANO GEORGE FRANCIS	1970	V/96/2396	A/5305	DIP. ED	HIST/GEOG	8	CLASS TEACHER	80,000

Oxford High School
Box 2034,
Mbale

CONSENT LIST FOR ~~NABBALE~~ NKOMA S.S · ~~CO~~

DATE 14/06/2011.

S2.

1. KAINZA FREDA (U1)
2. KUKUTU MICHAEL (U2)
3. TALISUNH MICHEAL (U3)
4. NAFIBUYA BELLA (U4)
5. HALOMA ABUDALA (U5)
6. WODYEMERA EMMA (U6)
7. KIRYA MUHAMADI (U7)
8. WAPUKHULU BOSCO (U8)
9. BUGANZA DIANA (U9)
10. NAWTABO SAIDUNA (U10)
11. WOSUKIRA SULAIMAN (U11)
12. NAMAKULA BEATRICE (U12)
13. NANKANJA FATUMA (U13)
14. ADEKE EVERLINE (U14)
15. APOLOI EVERLINE (U15)
16. BUWULE SARAH (U16)
17. WAMBEDE SULA (U17)
18. WANZUSI KEVIN (U18)
19. KALYEBI BULAIMU (U19)
20. MASIKO BASHIR (U20)
21. MANEKE FATUMATI (U21)
22. WANDULU PAUL (U22)
23. OSAMA SSALI (U23)
24. NALUMANSI ARAFA (U24)

CONSENT LIST FOR MBALE S.S

DATE: 15/06/2011

S2

1	WABUYARA	PENINA	(Y1)
2	MWOLOBI	SDECIOZA	(Y2)
3	Seera	mercy	(Y3)
4	NAMAISI	ABDALAH	(Y4)
5	MUDEGI	EMMA	(Y5)
6	kamwada	Enock	(Y6)
7	KIOSA	RONALD	(Y7)
8	NAMUTOSI	IRENE	(Y8)
9	NAYAN	LABWA	(Y9)
10	NAKAYENZE	WINNIE	(Y10)
11	APOLOT	WINNIE	(Y11)
12	NAGUDI JANE	NAMUTOSI	(Y12)
13	NSEKANABO	MERCY	(Y13)
14	NAKAMI	CATHERINE	(Y14)
15	NABUDUWA	BRENDA	(Y15)
16	MUKWANA	ALI	(Y16)
17	NAMBUYA	EVALYNE	(Y17)
18	MAKAYI	IVAN	(Y18)
19	NAMBALE	MARTIN	(Y19)
20	KATISI	DIANA	(Y20)
21	KINYERA	PETER	(Y21)
22	WASAGALI	RACHAEL	(Y22)
23	KAKAIRE	DAVID	(Y23)
24	KWAGA	MARIAM	(Y24)

CONSENT LIST FOR MBALE COMPREHEN-
SIVE HIGH SCHOOL

DATE: 16/06/2011

S2.

1. WABULE CATHERINE (Z1)
2 KITUYI BILLAH (Z2)
3 OKELLO JOHN (Z3)
4. MUSEDE CAROLYNE (Z4)
5 MANYIFU TIMOTHY (Z5)
6 SHISA MILLY (Z6)
7 LUWEMBO SHAFIQ ZANDYA (Z7)
8 OBEL SADIK (Z8)
9 MASHATE PETER (Z9)
10 ANGRO JOHN JUNIOR (Z10)
11 AKELLO INNOCENT (Z11)
12 HSURUGA IBRAHIM (Z12)
13 NAFUNA SANDRA (Z13)
14 ADEA BRENDA (Z14)
15 MUHOLACHEHI ALLEN (Z15)

CONSENT LIST FOR OXFORD HIGH SCHOOL 16/06/2021.

S2:

1. KAMOTI HASSAN ABDU (X1)
2. MUTONYI MORGAN (X2)
3. WANOMBI ISMAIL (X3)
4. OKUKU EMMANUEL (X4)
5. NAMALIKE BALIAT (X5)
6. NALYAKA SHIFA (X6)
7. WANZALA EMMANUEL (X7)
8. AJOLO IRENE (X8)
9. MASABA GEORGE (X9)
10. NASIKE KUZAIFA (X10)
11. NAMBOZO CONSULATA (X11)
12. MANGO PATRICK (X12)
13. SKHONDE CALEB (X13)
14. SELERA SARAH RITAH (X14)
15. ARIOKOT ANNA MARGRET (X18)

CONSENT LIST FOR MBALE HIGH SCHOOL . 17th JUNE 2011.

S2.

1. MUDUDY DAVID (W1)
2. KISOMBO YUSUF (W2)
3. KHAUKHA BILALI (W3)
4. BUTEMBO ASUMAN (W4)
5. KHALAYI DAIZY (W5)
6. NABUZALE AIDDIT (W6)
7. KIFUSE Madidu (W7)
8. WESWA HERBERT (W8)
9. BWIRE DANIEL (W9)
10. MUSIMAMI ROMAN (W10)
11. MUGOGA BEN (W11)
12. KWAGA IMELDA (W12)
13. NANDUDU SALAMA (W13)
14. NAMPUMA LYNNETTE (W14)
15. NAGUDI SHAKIRA (W15)

CONSENT LIST FOR BUGISU HIGH SCHOOL

27th/06/2011

S 2 STUDENTS

1.	NAMASABA	GRACE (V1)
	WOLUMBE	ANDREW (V2)
2	WAMIMBI	ABILI (V3)
3	GIME	DENIS (V4)
4	TEMBESI	RACHID (V5)
5	MUDUWA	SAMBRA (V6)
6	MANANA	SIMO Manana (V7)
7	KUJUNA	SAUL (V8)
8	APOLLO	MWAMBU (V9)
9	KIAMBOZIA	RICHARD (V10)
10	NEGESA	REHEMA (V11)
11	GUDOI	HASSAN (V12)
12	WADAMBA	STEVEN (V13)
13	MUZAKI	SARAH (V14)
15	SHELSHA M.	SHAMIRA (V15)

Test (On solubility of salts in water)

*Attempt **ALL** questions .* Time: 30 minutes.

Name of student...

School...

Section A

1. Negative ions are also called ....(1 mark)
2. Positive ions are also called...........................(1 mark)
3. An example of 'anion + alkali ion' is (fill the blanks)

   ....(anion) +.......(alkali ion) = ...(salt) (1 mark)
4. All .... salts are soluble in water (1 mark)
5. All .... are soluble in water (1 mark)
6. All compounds of ammonium ion (NH_4^+) and alkali metals (Group 1A) are .... (1 mark)
7. All...................... are soluble except those of Silver, Lead and Mercury(1) (1 mark)
8. All ....are soluble except those of Silver, Lead, Mercury(1), Calcium and Barium. (1 mark)
9. All ....are insoluble except those of ammonium, barium and alkali metal (Group 1A) cations. (1 mark)
10. All oxides are ....except those of ammonium, calcium, barium and alkali metal cations. (1 mark)
11. Soluble oxides react with water forming..........................(1 mark)

Section B

Write 'soluble' or 'insoluble' against the given salt

12. KCl... (1mark)
13. $CaSo_4$..(1mark)
14. $(NH_4)_2SO_4$ .... (1mark)
15. $NaNO_3$ .... (1mark)
16. AgCl.. (1mark)
17. $PbSO_4$.. (1mark)
18. AgOH.. (1mark)
19. $MgCO_3$.. (1mark)
20. $CuSO_4$.. (1mark)

Instrument 1: The Teachers' Tool

Background (Tick where necessary)
Particulars of respondent:

Gender: M ☐ F ☐

Age: 20-29 ☐ 30-39 ☐ 40-49 ☐ 50 - 60 ☐

Highest Qualification: Dip Ed ☐ Bsc. Ed ☐ BA. Ed ☐

M. Ed ☐ MSc ☐ MA ☐

Key: SD=strongly disagree, D-disagree, NA= Not applicable (or Not Sure), A= agree, SA=strongly agree

Class (es) you teach:..

Subject(s).......................................

Tick whatever applies

1 I rarely apply technology in the teaching-learning process.

SD ☐ D ☐ NA ☐ A ☐ SA ☐

2 ICT – integrated teaching –learning methodologies enhance the retention capacity of learners

SD ☐ D ☐ NA ☐ A ☐ SA ☐

3 The key to improved use of ICT is by including ICT equipment on the school budgets

SD ☐ D ☐ NA ☐ A ☐ SA ☐

4 I am not enthusiastic about technology, and even if ICT were Introduced in the teaching-learning process it would be inconsequential

SD ☐ D ☐ NA ☐ A ☐ SA ☐

5 Our head teacher is not keen on the use of ICT in the teaching/learning process and this has been an impediment in a way.

SD ☐ D ☐ NA ☐ A ☐ SA ☐

6 The equipment needed in order to implement an ICT-integrated teaching/learning process are expensive

SD ☐ D ☐ NA ☐ A ☐ SA ☐

7 I need in-service training (retooling) in order to apply ICT in the teaching – learning process

SD ☐ D ☐ NA ☐ A ☐ SA ☐

8 Computer science and application of computer technology are areas for science teachers and those who have done computer studies.

SD ☐ D ☐ NA ☐ A ☐ SA ☐

9 Applying computer technology in the teaching-learning process would delay curriculum coverage

SD ☐ D ☐ NA ☐ A ☐ SA ☐

10 There is no significant difference in the achievement levels of students whether teachers apply ICT – integrated teaching or not

SD ☐ D ☐ NA ☐ A ☐ SA ☐

11 I did not get adequate exposure to ICT at home, school and teacher college

SD ☐ D ☐ NA ☐ A ☐ SA ☐

12 Lack of access to internet is one of the major hindrances to the use of ICT in the teaching-learning process

SD ☐ D ☐ NA ☐ A ☐ SA ☐

13 Surfing the Internet is expensive in Uganda today

SD ☐ D ☐ NA ☐ A ☐ SA ☐

CURRICULUM VITA

A) Personal profile

Name	:	Sentalo Alex
Birth	:	28th October. 1962
Nationality	:	Ugandan

B) Educational Background

Teso College Aloet: UCE (1980), UACE (1983)

Makerere University: BSc with Education (1986), MSc (2001)

On line study : Cert E- learning (2002)

C) Employment Background

Teacher/ Head of Maths: Manjasi High School (1986- 1991)

Teacher/ Head of Maths: Makerere College School (1993-2004)

Lecturer : Uganda Martyrs University (2003-2004)

Lecturer: Islamic University in Uganda (2004-2005)

Lecturer: Kumi University (2008-2009)

Senior inspector of schools: Ministry of Education and Sports (2004-2011)

D) Other Information

Research on the FORTH Interpreter using Turbo Vision (2001)