A Review of Good Practice in ICT and Special Educational Needs for Africa

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Acknowledgements

The following report is part of Imfundo's Knowledge Bank activities. It is written to inform Governments particularly Education Ministries and their partners of the potential for Information Communication Technology (ICT) to enhance learning within the Special Needs sector across Africa.

This study was assisted by several agencies in Africa and Europe. We would particularly like to thank the Ministry of Education in Ghana and especially the Special Needs Division for all their assistance in conducting this study. We would like to also thank the Imfundo team in London for assisting to organise the workshop with key stakeholders.

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Acronyms, Abbreviations and Frequently Used Terms

AAC – Augmentative and Alternative Communication

ASD – Autistic Spectrum Disorders

ASL – American Sign Language

AT – Assistive Technology

BSL – British Sign Language

CBR – Community Based Rehabilitation

ICT – Information and Communication Technologies

IEP – Individualised Education Programme

MDT – Multi-Disciplinary Team

MLD – Moderate learning Disability

MPT – Matching Person Technology

PLMD – Profound and Multiple Learning Difficulties

PWD – People With disabilities

Sp ED – Special Education Division

SEN – Special Educational Needs

SLD – Specific Learning Difficulty

Terms Frequently Used[2]

Vision Impaired is now widely accepted among organisations rather than "blind". Blind can be used for persons with no vision.

Hearing Impaired includes those with hearing deficits and deaf from total hearing loss.

General Learning Disabilities includes people classified as having mild, moderate and severe/profound disabilities. The USA still uses the term "mental retardation" as a classification. The words, mild, moderate, severe and profound are also used with learning disability. In the UK, the Department of Health has used the terms moderate, severe and profound. These have been linked to IQ test scores.

ICT is a generic term, which encompasses a range of technologies including audio, video, TV, standard PCs, and peripherals to more specialised adapted technologies designed for individual use.

[2] Recent recommendations have called for a more participative classification for an individual with a handicap or disability. The WHO has therefore recommended a shift from "disability" to "activity", and "handicap" to "participation".

Introduction

{tc "Background to the review"}
" Good quality education is available to only a small proportion of children with special needs. Children with disabilities, especially girls, are far less likely to attend primary school. Many of those who do go to school receive an education that is entirely inappropriate. Educational disadvantage prevents children with special needs from gaining the skills and confidence that they need to avoid extreme poverty in adulthood (Oxfam Education Report, 2002)".

The aim of this study is to investigate how *good* practice and experiences from global use of Assistive Technology (AT) can be shared with African governments and people working in the sector. The study focuses on the use of ICT to support Special Educational Needs in Africa with particular reference to special schools, teacher education and inclusive educational programming. The main disability groups considered are the hearing impaired, vision impaired and children with general learning disabilities. The study forms part of Imfundo's KnowledgeBank activity on ICT and Special Educational Needs in Africa. The second phase of the research involves assisting the Ghana Education Service and the Special Education Division (SpED) in particular to support the appropriate ICT strategy for special education in Ghana.

Reaching the disabled and "bridging the gap" is an overarching theme for achieving Education for All. The purpose of this study is to: i*dentify "good" practice and examples in using suitable and appropriate ICT based solutions for enhancing both the quality and quantity of Special Educational Needs in Africa with the aim of assisting Governments develop policy and formulate strategic plans in the coming years (Imfundo, 2003).*

Over 10% of the world's population suffer from a variety of 'disabilities' and 82 per cent of disabled people live below the poverty line in developing countries according to estimates from the World Health Organisation. Governments in the developing world and development partners do not generally include people with disabilities. Gradually, however, the social and human rights approach to disability – as expressed in the World Action Programme (1982), the UN Standard Rules (1993), the International Classification of Functioning, Disability and Health (ICF, 2001) and in the approaches incorporated into EU policy – are being adopted by Governments and international institutions around the world (http://www.add.org.uk/projects_education.html).

Children in developing countries particularly those with disabilities and special educational needs are often marginalised from under-resourced and poor quality education systems due to lack of funding. Studies across Africa reveal the growing number of children who remain out of school, lack basic literacy skills and infrastructure (e.g. electricity). Children with special educational needs are confronting major challenges:

- 62 million children of primary school age cope with disability.
- Three times this amount are older children who have not completed primary school.
- Fewer than 2% of children with disabilities in developing countries are in school
- A disproportionate[3] number of children with disability are out of school.

[3] Oxfam Education Report, 2002

- Children are the future-- yet only 7% of disabled children receive any sort of education in developing countries.

Outline of the Report

This report is divided into six sections. Section one explores the definition, context and research available on ICT and Special Educational Needs with particular reference to Africa. Section two provides an overview of the policies guiding ICT and Special Educational Needs in Africa. Section three highlights the key lessons learned and experiences from non-African contexts in the use of ICT and Special Educational Needs. Section four discusses the experience of ICT and Special Educational Needs in Africa. Section five presents the challenges and the expectations of ICT within the Special Needs sector as well as examples of ICT resources, which are currently available on the continent. It also provides key recommendations and guidelines for African Governments considering the integration of ICT within the special needs sector. The study's main focus is on teacher education, inclusive education and special schools. The final section presents concrete proposals for Imfundo's partners, promoting global relationships and potential donor support to Africa.

Methodology of the Study

The study is based on existing research on the global use of Assistive Technology and ICT based resources within the Special Needs sector with particular reference to the African context. The study on ICT and Special Educational Needs was primarily a qualitative study involving the following methodological approaches:

- A desk review of ICT and special needs policies and the identification of case studies of best practices in Africa;
- An Internet based search of international examples of ICT and Special Educational Needs including children who are visually/ hearing impaired as well as children having general learning disabilities;
- Fieldwork in Ghana and Ethiopia to identify challenges and lessons learned in the application of ICT within the African context;
- A questionnaire for 20 head teachers and 10 deputy heads of special needs institutions focussed on the usage, and limitations of ICT within the education sector;
- Interviews with selected experts in the field of ICT and Special Needs particularly in Europe and Africa;
- Support from Imfundo's partners in gaining access to information and advice concerning SEN globally and in Africa.

The desk review included documentation and research on SEN, attempting to capture examples of innovation or good practice particularly with regard to Africa and other developing countries. The international Internet based survey included a four week search, identification and selection of examples of high, medium and low technical approaches to integrating ICT into the special needs sector. Selection of good practice was made and many of the case studies are contained in this review.

The fieldwork in Ghana assisted the team to contextualise their preliminary findings and consider concrete challenges within the special needs sector in Africa before looking at

how ICT could assist. Finally, interviews and consultations were held with experts from around the world concerning the use of ICT using the Imfundo database and UNESCO expert meeting on ICT and Disabilities, which introduced the team to other programmes in Southern Africa.

The paper is written for African Governments and stakeholders planning to introduce ICT into the continent. It provides basic information for those who may or may not be familiar with Assistive Technology from the low to high end and for three large, disability groups (i.e. visually impaired, hearing impaired and those with general learning disabilities).

1.0 Defining the Terms and Context of ICT and Special Educational Needs in Africa

The term “Special Education” is loosely used to describe the extra support provided by schools, colleges, universities, government education and health departments for students who may be unable to follow a mainstream curriculum because of a learning disability. This includes children whose general intellect and ability to learn is significantly restricted compared with that of the majority of their peers. This will cover a considerable range: from children who can communicate readily in words and who can read and write, to children with no ability to use language. Special Education also includes the provision of special institutions or schools that cater for a specific sensory impairment (e.g. blindness). These may include Schools for the Visually Impaired and Hearing Impaired or units attached to mainstream schools.

Special Education also refers to “inclusiveness,” where students are integrated into mainstream education with extra support. This support has been, until recently, in the form of human resources. The advent of ICT is beginning to help reduce the heavy financial burden Special Education places on education departments and should build workable, sustainable solutions that can enhance students ability to perform at his or her highest potential. This section draws on the uses of ICT or Assistive Technology for developing vital life, communication and independence skills.

1.1 Assistive Technology

Assistive Technology (AT) or Enabling or Adaptive Technology has been with us for hundreds of years, as in the use of a strong branch as a walking aid or a magnifying glass to read with. The past decade has seen the growth of technology applications such as Braille printers and the manipulation of the computer through voice commands. Assistive Technology is a broad term often used to describe both the products and services for people with special needs. It enhances the vocation, recreation, education, and independence of the learner. A commonly quoted definition of Assistive Technology derives from American legislation.

> *The Assistive Technology Act (1998) and the IDEA (Amended 1997) define an AT device as any item, piece of equipment, or product system (whether acquired off the shelf, modified, or customised) that is used to increase, maintain, or improve the functional capabilities of an individual with a disability. AT devices may be categorised as no technology, low technology, or high technology (LD Online, 2001).*

Whatever “label” we employ for special needs children – handicapped, mental retardation, disability, or impairment – individuals who are unable to participate in society adequately, require support to carry out a specific function or activity in their lives. The use of this support through unsophisticated and largely non-electronic devices such as a crutch, or more technologically advanced in the form of a synthesised speech output device, can enable children and adults who are often excluded from participating in a community and from enjoying a degree of independence in their daily lives.

The 21st century has moved us into a new era particularly in the western world where students with varying disabilities are using ICT to access the school curriculum and become mainstreamed into regular classrooms. Those with severe communication and physical conditions are using Assistive Technology to participate in classroom learning activities. At one end of the special needs spectrum are those pupils for whom ICT provision is fundamental, giving access to the world of living and learning in a way that no other resource can. At the other end of the spectrum are those for whom ICT is a facilitator, giving a level of support that will encourage them to concentrate on the content of learning without being limited by their impairment or disability.

1.2 Definition and characteristics of “new ICT"

There are four basic differences between mediated ICT and traditional ICT. These include multi-media, interactivity, flexibility of use and connectivity. These four dimensions distinguish digital ICT from previous technologies (Claudio Menezes, UNESCO). New ICTs allow students and teachers to control, manipulate and contribute information to the learning environment (i.e. interactive books on the Internet). Different from programmed media such as radio and traditional television, new ICTs have made it possible to develop "virtual" learning experiences. There is flexibility in the use of ICT since people can use it at home, school or in the community. Connectivity of new ICTs allows students and teachers to communicate with every person on the planet having an Internet account. The strengths of virtual learning are now becoming apparent to teachers and lecturers and are challenging the traditional learning styles of teaching the disabled. It is also enabling those with impairments and/or disabilities to become more visible learners participating on an equal basis with their able counterparts in the workforce and society as a whole.

New pedagogical methods, access to remote resources, collaboration between individual and groups of people in widely diverse geographic locations, online experts and mentors, virtual learning communities, home/school communication are some innovations of the "new ICT". Cost effectiveness of these ICTs have still not been fully explored (UNESCO, 2000).

1.3 Making technology fit: Individualised Educational Programmes (IEPs)

Educational practitioners are becoming aware of the strengths of Assistive Technology (AT) and how it can help overcome some of the functional barriers created by disability, enabling students to communicate, read and write more effectively. AT can also create new barriers if it is not carefully matched with the individual, which can lead to disappointment and possible abandonment as a result. It is important to consider a range of strategies when deciding to introduce a new piece of equipment or software to a student. Individual assessment and decision-making should be carried out through a Multi-Disciplinary Team (MDT) at the school level. In a western context a team usually consists of the child's teacher; the parents; the child, if determined appropriate; an agency representative who is qualified to provide or supervise the provision of special education; and other individuals at the parents' or agency's discretion who have detailed knowledge of the individual's needs and background. The MDT team can assess the specific needs, strengths, potential settings for the technology to be used, the cognitive ability of the individual and the technical support available.

Legislation in the USA mandates that all pupils with an intellectual disability be entitled to a written statement commonly known as an Individualised Education Programme (IEP). This educational statement provides an overview of a pupil's needs and prioritises skills and behaviours for their development. The technology planning should not dictate the setting of goals and targets. Careful consideration must be given to the "relevance" of any piece of software or hardware (e.g. mouse, keyboard) that is introduced to the pupil and the teaching competency of the staff at the school using it.

The Department for Education and Skills (DfES) in the UK have introduced a SEN Toolkit on their website with a downloadable document on a code of practice for drafting or managing an IEP. There are also useful guidelines on how to choose a framework and build your own template for multiple uses.

The National Centre to Improve Practice in Special Education through Technology, Media and Materials (NCIP) proposes four key elements of effective teaching practice:

- Engineer the classroom environment to optimise access to learning,
- Modify the instructional strategies, materials and tools to meet individual needs,
- Integrate the curriculum through theme-based learning or project-based learning,
- Embed assessment in all classroom activities.

http://www2.edc.org./NCIP/tour/toc.htm

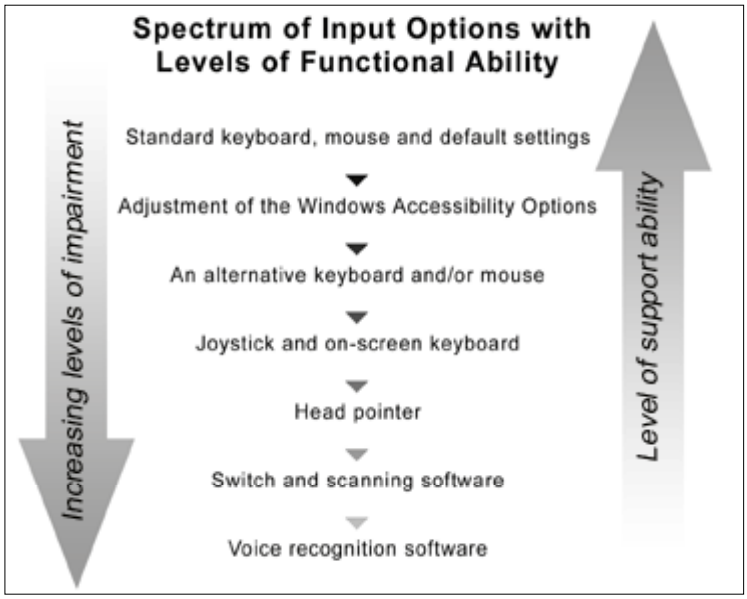
The **Matching Person Technology (MPT)** Model contains a series of instruments designed for technology providers concerned with the match of person and technology.

Three components remain the same in all situations:

- The characteristics of the environment in which the technology and user interact,
- The characteristics of the Person who will use it;
- The characteristics of the Technology itself.

1.4 Level of impairment against Input Options

In a European context schools are often using a range of ICT solutions that can be achieved by 'middle' range technologies. One common approach is to use a computer that is working as close to normal and then add various input options depending on the level of impairment until the optimum choice is reached. There is a certain amount of *trial and error* where a pupil should have the opportunity to try out the various options over a period of time. It takes time for someone to learn how to manipulate a new piece of technology and it is necessary to provide as much time and encouragement as possible for pupils with disabilities using a piece of technology.



Adapted from Enabling Technologies: Guidelines for the use of Assistive Technology in Education. "Solas" Project 2001.

1.5 Range of Technologies and Skills enhancement

Definitions for disability are often very broad and cover a vast range of technology options, from low-tech assistive aids for daily living, medium-tech assistive technology for reading and writing to high tech assistive aids for communication and mobility.

- **Low-Tech Assistive Technology** can be defined as any item, which is non-electronic. Devices that fall into this category include widened pencil grips, tactile books, Velcro fasteners, and communication cards. Many of these aids are produced on a commercial "one-size-fits-all" basis.
- **Medium-Tech Assistive Technology** includes devices used by individuals with some degree of independent functioning. Computer peripherals such as tracker balls, joysticks and big keyboards can be grouped within this category (See Annex 2 for list of hardware suppliers).
- **High-Tech Assistive Technology** can be defined as any item, piece of equipment or product system whether acquired commercially, *off the shelf*, modified or customised that are used to increase or improve functional individual capabilities with disabilities and are electronically or battery driven. Considerable specialist support and training are necessary to operate some of this technology.

The range of Assistive Technology can be further divided into the following areas:

- *Face-to-Face Communication Aids* refers to communication displays and voice output aids.
- *Written Communication* includes the full range of hardware and software required for written/graphic output and educational access (e.g. from pencil grip to alternative keyboard access).
- *Education Aids* includes a variety of hardware and software to access education. (e.g. communication aids, big keyboards)
- *Mobility Aids* refer to any aid that will augment or replace ambulation (e.g. a powered wheelchair).
- *Environmental Controls* are functional manipulation tasks that can be aided by assistive technology (e.g. modification of a utensil for easier grasping to modification by adding electronic controls for operation). (http://www.enableireland.ie)

Developing Skills through ICT

The box below describes some of the basic skills, which can be developed with learners using ICT. Classroom teachers can identify the strengths and weaknesses of an individual through the creation of an IEP which prioritises skills that need to be developed. Skills can also be assessed on a continuous basis by means of a checklist.

Hierarchy of ICT skills for teachers to develop in children

Level One: Attending Skills

- Develop skills of focusing, selecting, attending and tracking.
  - Attending to visual or auditory
  - Facial expression – pleasure
  - Body language e.g. claps hands, stamps feet.

Level Two: Operating Skills

- Use technology with intention and with understanding of cause and effect.
  - Responds by expression, smile, laugh
  - Indicates gesture, head nod, pointing
  - Uses augmented communication e.g. sign language
  - Makes utterances
  - Naming
  - Makes choices e.g. can choose between two items

Level Three: Functional Skills: Independent operation

- Choose to use the technology for their own purpose.
  - Making requests using gestures, facial expressions, sign, visual, language cues to use the adaptive device/computer
  - Engaging with technology e.g. via speech, music, sounds
  - Recognition of images on screen through gesture, facial expression, body language, sign, sounds
  - Following visual voiced directions
  - Following cursor visually
  - Moving mouse
  - Clicking at appropriate time
  - Dragging objects across the screen
  - Able to complete program and choose another.

The short list of software suppliers in Annex 4 gives some indication of how the above-mentioned skills can be developed and augmented through an extensive range of SEN software packages. There is a wide range of software available on the educational market. It is, therefore, vital that teachers, other staff and parents decide together when it comes to choosing a software title. Computer programs should provide a wide range of educational activities at different levels. It is advised to use standard software packages where possible, as they are usually easier to purchase, maintain and replace.

1.6 Children with General Learning Disabilities

The 1996 British Education Act defines a person with "a learning disability as one who has a significantly greater difficulty than the majority of learners". These range from

people with relatively Mild or Moderate Learning Disabilities (MLD) to individuals who have Severe or Profound / Multiple Learning Disabilities (PMLD).

Some students with moderate to severe or profound learning disabilities may need to use some form of Alternative and Augmentative Communication (AAC). This refers to methods of communication used by those who have difficulty with speech, language and communication. AAC aims to help compensate for these difficulties by providing, either, *alternatives* to speech through writing, sign language or pointing to pictures to get your message across, or alternatively, through *augmenting* what a student is saying using gesture, facial expressions in order to confirm a message. AAC uses a range of low and high assistive technology including communication boards, charts to dedicated voice-output software (See Annex 6 - software for autism).

There are many disabilities that can impair a person's ability to communicate including Autistic Spectrum Disorders (ASD), Cerebral Palsy, Encephalitis, traumatic brain injuries and degenerative conditions including Motor Neurone Disease. AAC has helped to enable these students to communicate a need or response to a question and reduce the level of frustration and powerlessness often felt by speech and language impaired persons.

A wide range of information and communication technology (ICT) equipment is available for children with learning difficulties based on low-tech aids (e.g. tape recorders to medium-tech, solutions (such as computers and peripheral equipment).

Some of the equipment includes:

- **Multimedia** includes moving images, graphics and sound;
- **Overlay keyboards or screen grids** which enhance traditional keyboards with use of symbols and other support;
- **Speech recognition systems** which enable learners to create text or control the computer through the voice input;
- **Spell checkers, glossaries and thesaurus** support for dyslexic enabling them to check the accuracy of work;
- **Touch screens** enable the computer to react to the touch of the screen;
- **Word processors** and those with voice output in order to create text;
- **Drill and practice software** assist learners who need to "over learn" concepts and practice basic skills in a range of contexts;
- **Assessment software** to enable teachers to assess the abilities of learners.

ICT can be a powerful resource to support and enhance curriculum experiences particularly for students with learning difficulties. This in turn encourages motivation and the development of skills (see www.ictadvice.org.uk). One of the new innovations is the "the reading pen" which is an alternative support for children and adults who have visual difficulties reducing their abilities to extract the meaning of a text. The

Communication Aids for Language Learning (CALL) is a comprehensive resource for investigating ICT innovations, projects and "tips" for the learning challenged (see http://callcenter.education.ed.ac.uk).

1.7 Software Packages for Students with General Learning Disabilities

Educational software companies are increasingly developing software for students with general learning disabilities. Many software packages utilised in the classroom for students with mild to moderate learning difficulties tend to be designed for mainstream students. However, teachers are able to utilise software packages in order to teach or practise a specific skill. The term “bricolage” is commonly used when deciding on and implementing software for students with specific needs. No single piece of software can meet the myriad requirements (e.g. maths, literacy, etc.) of an Individualised Education Programme (IEP). Teachers need to search, select and test software packages in order to develop greater skills and consolidate skills learnt away from the computer. Multi-modal teaching strategies, where students are able to maximise their strengths and simultaneously enhance under-developed skills, should be encouraged within the classroom, at home and in the community. Annexes 3, 4 and 5 describe a variety of software available and Internet websites to refer to when deciding what software to purchase.

Content-free software

These are programs, which allow students and teachers to add text, symbols, graphics, speech and sound into a template. The most commonly used content-free software used in classrooms are word-processing programs. These can be personalised by selecting typeface, type size, text and background colour, speech output options, graphics and picture support, on-screen keyboards, wordlists and customised spelling checks. Some examples include:

- Word-processors – Word, Power Point, Publisher and Excel, Notepad, WordPad and Paint,
- Clicker (Crick Software),
- Widget Software Ltd.– e.g. Writing with Symbols 2000 or Boardmaker

Content-rich software

These are programs that offer teachers and students a range of ready-to-use computer activities. This software includes Reference software (e.g. Encarta), Drill and Practice programs and Skills Building programs:

Reference Software

These contain a body of information on a particular subject or domain. The software also contains activities and interactive elements based on the content. For students with

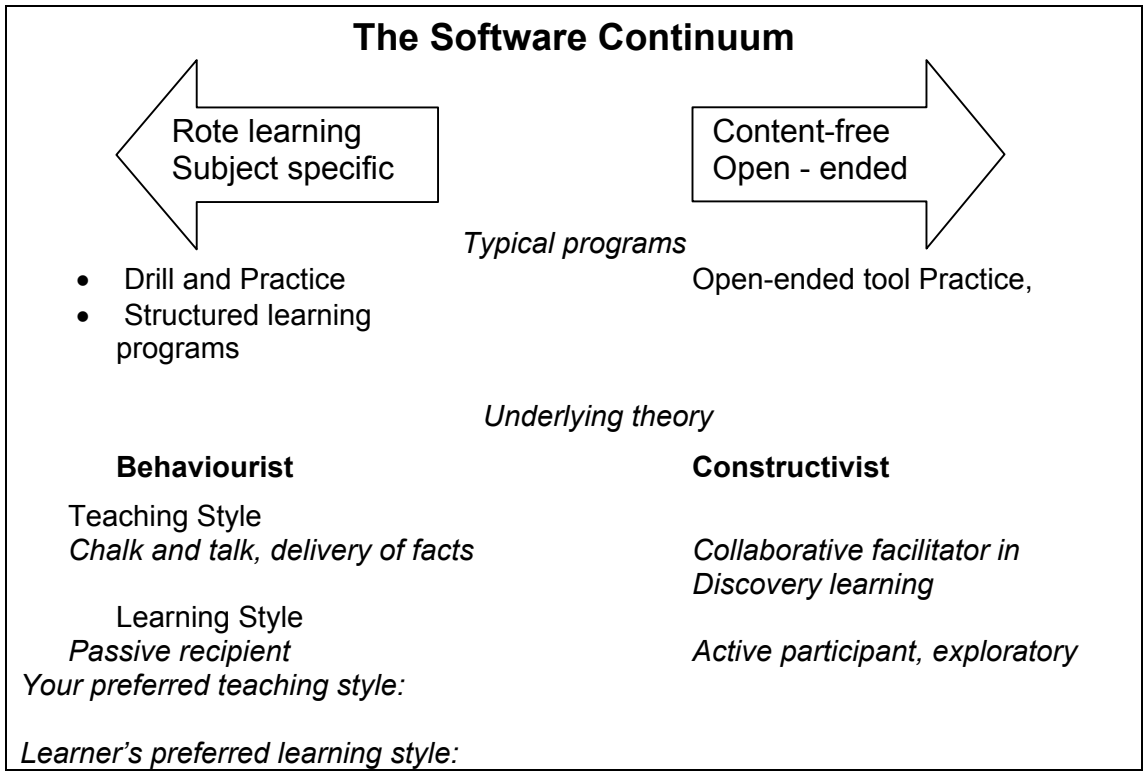
moderate learning disabilities it is vital that the information be presented in a stimulating and age-appropriate way, have an appropriate and consistent level of language and contain suitable menu and navigation structures as well as supportive graphics and sound resources.

Drill and Practice

These software packages are useful for students in practising phonics, number work and other basic literacy skills that teachers are unable to consolidate with students due to class sizes and time restrictions. Software that allows the teacher to differentiate the content and monitor individual students' activities and records and has supportive documentation and supplementary materials for use away from the computer is desirable in a busy classroom environment. There is a range of software available depending on the learners' needs and teachers' preferences (see Software Continuum box below).

Skills Building

These help novice computer users learn to type and identify hot keys and short cuts on the keyboard. Specific software programs (e.g. JAWS and Zoomtext) teach shorts cuts in order to help the vision impaired user become more adept at accessing and using programs on a computer. The International Computer Driving Licence (ICDL) is one course that provides skill building for adult learners on how to develop spreadsheets and use PowerPoint (see http://www.icdl.org.za). There is also a range of "keyboarding" packages that help the novice around the keyboard and teach her to touch type and accelerate speed with the aid of auditory feedback.



1.8 Teachers' Resources

Many multimedia programs can provide teachers with a framework or template within which to produce customised materials for students. These may be in the form of books, word banks or desk activities such as worksheets, word, number and picture games.

The computer can be an invaluable tool for administrative tasks such as writing reports and Individualised Education Programmes (IEPs). ICT can provide a research facility for staff members in obtaining access to information on educational, psychological and medical issues on the Internet and in maintaining contact with other teachers and educationalists in other countries through e-mail and on-line discussion boards.

Word Prediction and Mind-Mapping Programs

There has been an increase in the number of computer software products that help students organise their ideas and write them down with easy-to-use word processors. They range from basic phonetic awareness, sound-symbol correspondence to more advanced word prediction, grammar and vocabulary supporting capacities. Students are also able to use visual thinking software that helps reduce writing frustration by integrating maps, webs and other visual learning diagrams. The most useful programs offer auditory prompting and feedback to aid the user and provide him or her with a multi-sensory approach to learning. Some examples include:

- Reading Support Systems – e.g. Lexia and Simon Spells (Don Johnston),
- Word Prediction - Co: Writer 4000 (Don Johnston), Read & Write, Wordsmith (TextHelp!), Kurzweil 3000 (Kurzweil),
- Brainstorming and mind mapping – Kidspiration and Inspiration (Inspiration).

Computer-generated IEPs

As teachers' administrative workloads are becoming increasingly heavier, schools are looking at the introduction of ICT to help reduce paperwork for staff involved in the writing of Individualised Educational Plans (IEPs). There are various IEP frameworks proposed by worldwide agencies that can be photocopied, downloaded from the Internet or installed from CD Rom. In the USA, computer-generated IEPs have become popular as they save time and money (See http://www.iepwriter.co.uk/iep_writer.htm for templates and examples of IEPs used in the UK).

1.9 Why ICT and Special Educational Needs?

ICT, used in a planned and structured way, can support and stimulate students with SEN throughout the continuum of development. It can support the development of appropriate communication and cognitive skills while enabling independence. A very important result of using ICT is that the student is encouraged to move from a passive to an active role, or from a responsive to an initiating and interactive role. It also provides a series of age-appropriate materials and resources for students with general learning disabilities and teachers.

There is growing momentum within both the developed and developing country context towards mainstreaming children with special needs (i.e. integrating them into the mainstream classroom). Providing educational experiences for students with SEN within the mainstream curriculum is a tremendous challenge. The mainstream curriculum usually provides a clear structure within which many of the special educational needs can be catered for.

Typical skills taught in special classes within mainstream and special school classes in western countries include the following:

- Development of enabling skills: attending, responding and initiating
- Life skills: communication skills, personal and social skills, aesthetic and creative skills, physical, mathematical and ICT skills.

Depending upon the disability and appropriateness of inclusion, ICT can play a significant role in enabling students to access the curriculum and learn alongside their peers. It must be stressed that the inclusion of any child with a disability or impairment is much more difficult if sufficient planning is not undertaken beforehand. Too often, schools do not fully comply with education department demands that are equally under pressure to integrate students with Special Educational Needs. It is important to stress that those students who have the cognitive ability to participate within a mainstream setting with the support of AT or enabling technologies need to be encouraged.

Schools in Africa faced with the integration of students with sensory impairments (e.g. blindness, deafness) need to know that there is support from Special Education Divisions to help advise and provide material support so that the integration into the mainstream is smooth and effective. This process requires a commitment by the educational authorities to provide the necessary resources and training for special

needs division advisers and teachers. We cannot expect teachers to be able to accommodate and provide adequate support unless they have been trained to do so.

Teacher training colleges and universities should include modules within their teacher training programmes and distance education programmes for special education. Modules within these programmes should be dedicated to ICT and SEN. Teacher Training courses such as the Bachelor of Education (B.Ed.) degree in the UK and Ireland include a short course on ICT with a module on Special Education software. More specific courses for vision and hearing impaired children are often run by smaller agencies such as ICT assessment centres and schools working with children with disabilities. However, certain schools for the blind and deaf can offer teachers and other interested parties courses on learning to read Braille or in the use of AT devices in the classroom. It is always useful to contact special schools to see how they are using technology and enquire about their certificate and diploma courses.

2.0 Setting ICT and Special Educational Needs within an African Context.

Efforts to educate children with disabilities in Africa have focussed mainly on the provision of special schools and private voluntary efforts with some countries introducing approaches focussed on Community Based Rehabilitation (CBR). There is a growing emphasis on helping children with SEN to integrate into the mainstream or become more "included", but very few countries in the developing world have been able to provide adequate resourcing and models for inclusive education despite the international targets set by the Education for All global campaign.

2.1 Access to Special Educational Needs in Africa

Generally, access of children to Special Education in Africa remains very small due to the limited coverage, resourcing and support for special schools. This is coupled with poor educational quality often due to few trained, motivated staff and limited access to appropriate and cost effective teaching learning materials (Casely-Hayford, 2002). Table 1.0 summarises some of the challenges of Special Educational Needs access across the developing world:

Table 1.0: Examples of Special Educational Needs Coverage in the Developing World

Country	Access to Special Educational Needs
Zambia	• More than half of the disabled adults have received no education, which is double the proportion for the general population. • There are 120 special schools servicing 25,000 children out of a population of 175,000 disabled children of primary school age.
Ghana	• Only 2% of children with disabilities are provided with special education in less than 29 special schools. The inclusive education programmes for the visually impaired reach out to less than 1% of the primary school age population.
China	• Special needs schools in China reach only 130,000 children out of an estimated disabled child population of over 8 million. Fewer than 2% of Blind children and 0.3% of children with learning difficulties are in school.
India	• Research from the 1990's placed India's disabled child population at 3,000,000 with less than 1% receiving education through special needs schools.

Source: Oxfam Education Report, 2002

Despite their visibility, the large majority of special schools are providing education for a very small proportion of children with Special Educational Needs. Governments across the world are moving towards inclusive education. However, in the developing world,

they rarely accompany education policies with adequate resourcing, teacher training and policy changes.[4]

ICT to a large extent remains out of reach of most African education systems although there is growing interest and commitment. The Education for All campaign has placed Special Education on the agenda of many governments with some emphasis on providing adequate teaching and learning materials. The challenge remains on how to achieve these targets and commitments.

Lack of basic communication and electronic infrastructure remains one of the greatest hurdles for Governments; other challenges include the provision of adequate resourcing for low to medium technology applications such as teaching - learning aids. One only has to look at the limited access to computer and information technology to recognise the gap. Studies in Ghana suggest that less than 2 out of 40 special needs teachers are using high technological devices in the classroom and only 5 out of 40 special needs teachers use low technological approaches in their classroom (Casely-Hayford and Lynch, 2003)[5].

The most daunting task for African Governments is to find the resources to ensure that teachers have relevant and appropriate teaching tools in the classroom. Currently, the vast majority of budgets are spent on teacher/administrator salaries with little left in the area for "servicing" or providing the basic learning tools including books and writing materials. Special schools remain woefully under-resourced and sometimes incapacitated due to problems with technology. Even small technical hitches including poor “housekeeping” or maintenance can result in PCs malfunctioning. Donations of technology can often be more of a burden than a gift for an already struggling education sector. The Braille printing press in Ghana was one such example.[6] In July 2003, Barclay’s Bank donated a modern Braille printing machine, two computers and a renovated printing house at total cost of 630 million Cedis to the Ghana Association of the Blind (GAB).

Despite the rising potential that ICT has for children in Africa with moderate to severe learning disabilities, they remain out of reach of the African child particularly the higher, more sophisticated forms of assistive technology. The context in which teaching and learning takes place restricts access and entry into the world of ICT thus further

[4] The Spanish Government has been investing heavily in making the transition by reducing class sizes and ensuring that all schools have access to special needs support teams, specialised textbooks, teacher training to respond to special needs children.

[5] Questionnaires Responses on ICT and Special Needs in Ghana.

[6] The Braille machine in Ghana has been non-functional for the last two years. The machine was given by a developed country aid programme but was outmoded and outdated when it arrived over 10 years ago. Since then it has been serviced once in Europe and sent back but again has broken down. This is the only machine, which the entire sector depends, for the production of school textbooks for Blind children in the country.

widening the *digital divide*. Poverty and basic needs remain the top priority of Governments. Support for improving the ICT context in Africa are met with warm reception but the need to "bridge the gap" is a complex one requiring organic home grown solutions, particularly in the face of growing food security, conflict and insecurity on the continent.

The next few sections present a few, yet promising cases of how ICT is helping to "bridge the gap" and bring the world to the doorstep of Africa. This study reveals the need for a much more comprehensive ICT policy environment within the education sector before Special Educational Needs can make an impact. One promising case is the Ethiopian Government's initiative to use ICT at the senior secondary level, which aims to provide over 500 high schools with access to television and educational broadcasting in 2004. Section 4.0 will provide more details of examples of ICT within the Special Education Needs context on the African continent.

2.2 Bridging the Digital Divide in Africa

If we look at the African continent we can see the enormity of the *digital divide*. Africa's population can be estimated at almost 750 million people; however, in 1999 there was less than 20 million phone lines – fewer than in Manhattan or Tokyo (Abungu *et al*, 1999). While Internet use is not limited to certain groups of individuals in industrial countries, the Internet users in developing countries are mostly young, male, urban individuals in the middle and upper income groups. The more advanced developing countries such as the Newly Industrialised Economies (NIEs), Brazil, Chile, Estonia and Malaysia have made enormous progress toward a digital economy (Yun-Hwan Kim, 2002).

Several worrying statistics were registered in the "World Communication and Information Report 1999-2000". Poor infrastructure remains one of the most daunting tasks to reversing the growing divide. Due to these obstacles recent attempts have been made to establish the relative costs of ICT in Education. An important aspect of cost effectiveness is its threshold dependence on per capita income, which may pose an additional burden in offering ICT to disadvantaged and excluded students in low-income regions.

A major obstacle to African countries gaining access to digital information is the national telecommunications infrastructure. The Internet is dependent upon the quality of the underlying telecommunications infrastructure and so the poor quality of the network still remains a basic impediment to rapid development in this area (Abungu *et al*., 1999)

Teaching through ICT has been shown to be more cost effective than traditional programmes in developing regions of the world, especially in terms of unit costs for large student populations. Most African governments and communities would still find it difficult to afford the costs. These include installation and maintenance costs, recruiting and retaining skilled staff and the costs of supporting infrastructure in the form of broadband connectivity.

A series of basic principles and resolutions – which aims to *bridge the gap* of the Information Society between the "information rich" and "information poor" was recognised during meetings leading to the World Summit on the Information Society (WSIS) in Geneva 2003. One resolution recognises the need for "Human Resources Development" where developing countries have to strengthen their human, institutional and organisational capacities in order to enter the "Global Information Society". This is suggested by increasing the awareness for production of local ICT content and the use of local languages for ICT through 1) capacity-building and training programmes and 2) knowledge and expertise transfer

> *Volunteers have a natural niche in helping people and institutions acquire the skills and capacity to make good use of these technologies, as evidenced by initiatives like UNITes, NetCorps Canada, Volunteers in Technical Assistance, and many other organisations (WSIS 2003 – Observers' contributions to the Declaration of Principles).*

Other factors that can help bridge the digital divide include the following:

- **Universal access** – e.g. develop connectivity for institutions accessible to the public such as schools, libraries, post offices,
- **Broadband** – essential to strengthen regional and international broadband network infrastructure in order to provide the capacity to match the needs of countries and their citizens,
- **Low cost equipment** – The creation and provision of low cost access equipment,
- **Low cost connectivity –** Universal access policies to promote the best possible level of connectivity at a reasonable cost for under-served areas,
- **Interconnection –** to optimise the connections among major information networks need to be promoted through the creation of regional traffic hubs to reduce interconnection costs and allow for the penetration of access networks to be broadened,
- **Regional infrastructure –** regional ICT backbones and exchange points need to be implemented to facilitate traffic exchange between countries,
- **Open-Source Software/Free Software (OSS/FS) -** Open-Source Software/Free Software are programs whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers).

2.3 Policies and Programmes Guiding ICT and Special Educational Needs in Africa

When one compares the policy frameworks from the Western World to that which is available to protect and ensure the human rights of children with varying degrees of disability in Africa one can find reasons why there is so little momentum on the continent. While the USA has extensive legislation to protect the rights of the child particularly the disabled child, very few African governments have achieved the provision of universal basic education as a given right. The box below gives us some insight into the level of US legislation and its impact:

Individuals with Disabilities Education Act (IDEA 1997)

This Act specifically requires that public schools adapt the content in general education classrooms to meet the specific learning needs of special education students. It also states that public schools make available to all eligible children with disabilities a free appropriate public education in the least restrictive environment appropriate to their individual needs.

According to the U.S. Department of Education's Office of Special Education Programs, more students with disabilities are being educated in regular classrooms. In fact over 95% of students with disabilities ages 6-21 attend school with their non-disabled peers. These statistics reflect the very large group of diverse learners who must "access, participate and progress" in the general education curriculum.

Americans with Disabilities ACT (ADA)

Section 504 as well as other federal laws, including the Americans with Disabilities Act (ADA). Section 508 requires Federal electronic and information technology to be accessible to people with disabilities.

The Salamanca Declaration

> *"The key challenge is to ensure that the broad vision of education for all as an inclusive concept is reflected in national government and funding agency policies. Education for All…must take account of the need of … those with special needs…" (World Education Forum: Dakar Framework for Action, 2000 Paragraph 19)*

The Salamanca Declaration is the closest policy framework for protecting the rights of the child with disability in the developing world. Governments adopted the principle of inclusive education at the World Conference on Special Educational Needs, in 1994[7]. The importance of including children with disabilities was strongly reaffirmed at the UNESCO World Conference on Special Educational Needs in Salamanca (UNESCO 1994). This conference has been very influential in encouraging governments to adopt inclusive policies and in providing examples of progress in schools to respond to a much greater diversity of need in their local communities.

[7] " Informed by the principle of inclusion: that ordinary schools should accommodate all children regardless of their physical, intellectual, emotional, social, linguistic or other conditions" Salamanca Declaration, UNESCO, 1999.

Unfortunately, the *Salamanca Declaration* did not specify any guidelines or policy consideration in the area of assistive technology. Since 1994, many developing countries have attempted to move towards policies of "inclusive education but without making the necessary investments. The reality in Africa and other developing countries is that the chronic under-investment in education is preventing action towards inclusive education. Ordinary classroom teachers often receive limited guidance on how to teach children with disabilities; appropriate teaching materials--such as large print books -- are not available and furnishings and facilities are not adapted to the needs of disabled pupils *(Menezes, UNESCO, 2000).*

UNESCO is tasked with ensuring that Special Education forms part of every discussion dealing with education for all. The declaration also calls on all member states to reorient their education strategies and teacher education programmes towards inclusive education with teachers becoming more aware of the need to mainstream Special Educational Needs. The UNESCO Teacher Resource Pack for “Special Needs in the Classroom” was developed to assist governments adopt more inclusive education approaches. The UNESCO resource pack has been used widely to train teams of special teachers who were assigned as peripatetic teachers at district level, to support, advise, provide training and offer referral services when needed. In the areas of ICT and Special Educational Needs some of the tools developed by UNESCO for developing countries are contained in the following box.

- Welcoming Schools, teachers' stories on including children with disabilities into regular schools (1999) with accompanying video.
- Video " On the Deaf" with accompanying handbook which provides essential information to parents of the deaf, teachers and community workers specifically to the African context.

UNESCO Special Education Needs Web Site:
http://www.unesco.org/education/educprog/sne

Education for All Campaign Frameworks

The second major policy, which is related to Special Educational Needs in Africa, is the Education for All Movement, which has identified the need for children with special needs to be part of all targets for universal basic education. The Regional Framework for Action adopted by Sub Saharan Africa puts forward the following strategy for attaining universal basic education:

> *"New, appropriate and cost effective technologies shall be adopted to complement the integration of indigenous educational methodologies. Dependence on imported materials and technology, requiring an ever-increasing*

supply of scarce hard currency is not viable and shall be reduced as rapidly as possible. To start research and development investments shall be intensified for the development of locally available alternatives to imported paper, and books while import duties on paper and other materials required for domestic use are eliminated. The use of oral tradition, more effective in appropriate contexts shall be explored and systematised for teacher training and other education and training applications" (The Dakar Framework for Action, 2000, p.30).

This statement formulated by the Ministers of Education on the continent gives some insight into the resource limitations which the education system is facing given that basic provision for paper in all schools is proving difficult to achieve.

2.4 New Initiatives/ Developments in the ICT and Special Educational Needs Sector

Since the World Conference on Education for All (Jomtien, 1990) enormous steps have been taken to develop and improve the quality of education in developing countries but the gap is still wide.[8] There have been several initiatives by UNESCO and their partner agencies, in particular, to improve the linkages between ICT and Special Educational Needs. These include the following:

- **The creation of virtual universities and learning environments:** The World Bank has been establishing the African Virtual University (AVU), whose objective is to provide world-class degree programmes that support the economic growth of countries. The AVU holds great potential for assisting students with special learning needs particularly since it is designed to overcome the barriers of outdated equipment, declining budgets and increasing access to youth for higher education (http://www.avu.org).
- **Creating Learning Networks for African Teachers**: This programme connects teacher training colleges and their partners in education to the Internet, empowers teachers to use ICT and aims to build capacity to the new challenges of teaching and learning. Kenya and Senegal (http://www.ucad.sn/refes/) and Uganda and Zimbabwe (http://lwf.co.zw) have been participating in the pilot phase of the programme.
- **The International Institute for Information Technologies in Education (IITE)** (http://www.iite.ru) is an institute, which provides key stakeholders in education with information on the latest technologies for enhancing the learning process, guiding institutions on freely available tools for virtual learning. The institute has published a large set of materials on ICT and Education including: Information and Communication Technologies in education for people with special needs.

[8] 875 million adults, two thirds of who are women remain illiterate, and 113 million children have no access to school.

- **ICT and Disabilities (A Concept Paper): UNESCO 2003** Experts in the field of ICT and disabilities met together in Paris to put forward a series of recommendations, which will be incorporated into the design of UNESCO's programme of work during 2004-2005. It has a mandate through research, policy initiatives and partnerships with other institutions to contribute to improving the lives of persons with disabilities. This group of experts has also made a set of recommendations for the World Summit on the Information Society (WSIS).
- **SchoolNet Africa:** This site has a small section on Special Educational Needs in Africa and links to international websites on Special Educational Needs. It also has links to UNESCO papers on disability issues. This portal would be an excellent place for information concerning SEN and ICT to be disseminated (http://www.schoolnetafrica.net/).

Although many of these programmes do not necessarily target children and youth with special learning needs, they can easily integrate the learning needs of a variety of differently abled students once their capacity grows and the barriers to connectivity are overcome. Key to this will be students' abilities at higher education levels to access assistive technology as part of their basic learning needs.

Of particularly importance is Imfundo's initiative on ICT and education, which is a unique approach by the British Government to assist partners in considering how the full range of ICT can be used in education. Imfundo's work has particularly focused on teacher education and educational management systems in Sub-Saharan Africa. Imfundo's KnowledgeBank enables researchers, policy makers and practitioners to share information on ICT in Africa and links to online resources for teachers (see www.imfundo.org). Contributions to the Knowledgebank papers include research undertaken by the Royal National Institute of the Blind (See Fact Sheet – "The use of ICT for people under 16 with sight difficulties" http://imfundo.digitalbrain.com/imfundo/web/plan/sightdiff/?verb=view).

2.5 Educational Policies and the Challenge of Policy Implementation in Africa

Apart from Educational policies and programmes, a growing number of Governments within Africa are developing ICT policies which are overarching vision documents which map out the way forward for ICT development within a given country. A recent five-day workshop organised by SchoolNet Africa, The Commonwealth of Learning (COL), the International Institute for Communication and Development (IICD) and the World Bank (WB) in Gaborone, Botswana (April, 2003) where 28 countries were represented, identified a series of seven initiatives for policy makers and practitioners in ICT:

Key findings from the ICT and Educational Conference, April, 2003, Botswana

1. **Policy on ICTs in education with baseline studies** – video documentary of continent-wide promising practices, policy documents and statements, implementation plans and research, capacity building seminars for development and implementation of policies.

2. **Building capacity in human resources** – including building the pre and in-service teacher training system to use ICTs, reports on effective models for teacher training, development of distance learning teacher training courses, training on establishment and management of schoolnet organisations, schoolnet champions and technical training.

3. **Information sharing via a clearing house** – with Schoolnet Africa's Education Knowledge Warehouse being the 'clearing house' where ICTs in education policy documents, teacher training models and resources, specifications for refurbished computers, using ICTs for different subjects, subject based resources, research into issues like e-rates, using different technology platforms, open source software vs. propriety software, etc will be housed. Other documents and information will include annual reports on the current developments in ICTs in education on the continent.

4. **Gender** – that attention is given to mainstreaming gender issues in ICTs in education programs such as engendering ICTs in education policy and that specific projects to advance women and girls in education be considered.

5. **Technology developments** – for example the establishment of refurbishment centres as part of job-creation and support to the school system that uses refurbished computers. Also, global advocacy to lobby the private sector to donate refurbished computers at a greater quantity and reduced cost.

6. **Advocacy** – working with governments, institutions and agencies to clearly articulate the value of ICTs to the education system and to the countries economy and society.

7. **Research** – development of a baseline evaluation of prevalence of ICT in schools, evaluation of the impact of ICT on teaching and learning in the classroom, to include the development of open standards for educational software, identifying actual costs and benefits, how to assess and evaluate the use of ICTs, using ICTs to support learners with special needs, etc.

   (Source: http://www.col.org/newsrelease/0305IAS2003.htm)

Annor (2002) writing on the "Implementation of Government Policy for Supporting Technology Use by Persons with Disabilities" (PWD) highlights four main challenges which Governments in Africa will face in attempting to implement the disability policy. The first is the ability to mobilise the necessary resources needed to acquire and provide Assistive Technology. The educational budget has dwindled from 15% to 12.6 % GDP with less than 1% going towards the Special Educational Needs sub sector. The majority of these resources provide food subsidies at special needs institutions (Casely-Hayford, 2002).

The second major challenge for policy implementation is the ability and interest of the private sector to provide some of the technological needs. Given the emphasis on

African solutions for African problems within the EFA Framework for Action, many private public ICT programmes are required to address the growing needs. According to Annor, the market scope for providing Assistive Technology is unattractive to the private sector. The next challenge is the maintenance of such technologies when acquired. There is very little capacity within developing countries to respond to the maintenance of modern Assistive Technology (e.g. there is one audio unit in Ghana for repairing hearing aids). The final challenge for SEN policy implementation is the attitudes and perspectives which prevent institutional change. Many educational institutions and public places across the country do not take into consideration people with disabilities of any kind.

Below are some of the approaches that Annor (2002) suggests are necessary in order to respond to these challenges:

- adequate data collection and assessment of the need for technology for PWDs in the country;
- the development of a technological plan which includes the training of PWDs to develop and maintain Assistive Technology;
- the development of Assistive Technology as part of the curriculum for engineering Departments and Institutions of higher learning; and the
- the establishment of a link with institutions outside the country to facilitate the gradual transfer of appropriate technology for PWDs.

Customising AT to the individual's needs requires expertise that moves beyond the engineering departments of specialised technology institutions. It is a costly business ensuring that the prescribed piece of technology matches the disability. Few IT engineering firms are committed to providing technical support to clients who receive new AT. It is not uncommon for a delivered piece of new technology, such as a Braille tactile printer, to be left in the delivery box due to inadequate instructions on how to set up and use the device. Large pieces of technology often require careful installation by professionals who have a detailed knowledge of its mechanism. European exports to Africa need to have a sufficient back-up and technical support to ensure that the new technology is not abandoned or left "on the shelf". Some of the guidelines, which are appropriate for African Governments to consider when considering ICT within the SEN sector, are described in the box below.

Guiding Points for ICT use in the Education Sector

- ICT investment for education requires long term planning taking account of issues of sustainability and the new developments (i.e. ongoing costs, significant financial requirements and potential dependency on external funding)
- Governments in developing countries should consider less expensive more cost effective approaches such as educational television with community learning centers or telecenters
- Strategies, which allow developing countries to experiment with ICTs in different settings may assist countries, develop their own models of best practice. ICT investment should consider the full range of technology.
- Governments should consider the full range of technologies not just high end.
- Higher education is one area where ICTs can substantially assist teaching and learning.
- Cost effective use of ICTs requires regular maintenance and replacement; it also requires trained technicians and locally trained staff to make the most of the technology.
- Developing effective partnerships with government and private sector is key to improving the conditions for ICT use in the education sector (i.e. sharing soft ware)
- Sound ICT policy in education requires collaboration between policy makers in education, finance and telecommunications.

(http://www.ids.org… see Insights Feb 2003 edition on ICTs and Education).

An examination of the use of ICT in Special Education outside Africa provides a wide variety of examples. Still, use remains limited primarily to developed countries. The USA, the U.K., and Scandinavian countries appear to be in the forefront of ICT integration into SEN, with widespread integration of low, medium and high-technology assistive devices. The U.S. is also active in the use of ICT in SEN and has developed a number of state-run programs helping to reach students with special needs in rural areas of the country by providing technical assistance and devices.

Essentially, we see that programs work when they have funding, government support, and an encouraging environment, i.e. parents who are actively involved in their children's education and who are financially able to obtain assistive technology, materials and training for use by their child and in home life. A positive cultural attitude towards students with SEN and towards improving life for people with disabilities is also vital. While for the most part these conditions exist in countries such as the U.S. and U.K., other countries are battling against a high level of stigma and lack of support for SEN particularly within the education sector. The non-African experience with ICT in SEN shows us what is possible, and how we can make this happen in other parts of the world.

3.0 Non African Approaches and Lessons learned globally - ICT in Special Educational Needs.

3.1 Assistive Technology for Vision Impaired/blind individuals

The vision-impaired have been one of the most successful disability groups in adapting assistive technology and gaining access to information using ICT. Today blind people use specialist speech synthesis software to access and decipher the Internet and obtain information on their computers. This works by transforming the text on each web page into speech so that the blind person can hear it rather than rely on visual access. Many websites remain inaccessible to vision impaired users because of poor design and the use of techniques that restrict the ability of speech software to make sense of a site. One of the biggest problems is that software cannot detect images used to convey information.[9]

Very young students learning to use a computer will find it more accessible if they can learn to use a switch that can help them grasp the concept of "cause and effect". Students who understand the concept of causation and how it can affect the environment can move onto more demanding appliances such as auditory scanning and simple software that develops this basic skill. (See earlier table on "Hierarchy of ICT skills for teachers to develop in children"). The gradual progression to the keyboard through tactile overlays and speech output is a process that cannot be rushed. Further information on ways to introduce ICT to vision impaired students can be accessed on the Imfundo KnowledgeBank Partner Publications – "The use of ICT for people under 16 with sight difficulties" (http://imfundo.digitalbrain.com/imfundo/web/plan/sightdiff/?verb=view).

The availability and distribution of good content to the blind through library services varies quite extensively between developed and developing countries. The affordability of technology to produce and access materials is a challenge most countries in Africa cannot afford. The lack of infrastructure to support basic technologies including the telephone is presumed to be everywhere. Talking books, the most popular means of reading for those who are unable to read print, require electrical equipment to produce them and equipment to read them. Braille requires training, skills and instruction and the technology to emboss it—often unavailable in poor environments. One example of a highly successful library for the blind is in Canada (see box below or refer to www.cnib.ca/library).

[9] The World Wide Web Consortium (WC3) is a body that safeguards the standards underlying the web and has formulated guidelines to help web designers make their sites accessible. The W3C Website Accessibility Initiative (WAI)) is now widely accepted as the definitive statement on accessibility (see www.wc3.com/wai).

Libraries play an important part in the dissemination of knowledge and good practice. Computerised libraries are able to obtain resources and interconnect with other libraries thus creating a vast quantity of information. They are also at the forefront of providing access, help and training to people with disabilities. They will become more involved in providing electronic information, as their clientele becomes more IT literate.

The Canadian National Institute for the Blind (CNIB)

The CNIB Library for the Blind, a division of the CNIB, is a not-for-profit, national organization offering free library and information services to approximately 3,000,000 Canadians who are blind, visually impaired, and print-disabled. A recognized leader among libraries for the blind, the CNIB Library is one of the largest producers of materials in accessible formats in the world and circulates more than 1.8 million items each year. Its ever-growing collection includes Braille books, talking books, and a wide array of electronic and digital materials.

The CNIB Library has a children's section in the library and runs various events and competitions during the year including a Braille creative writing contest with lots of cash prizes, a Summer Reading Club with great books, free items, and Mystery Questions, all on the theme "A World of Difference." A monthly on-line publication "The Library Zone", featuring the latest books and Web sites for kids young and old. There is also an audio newsletter "Kidsworthy" with all sorts of Library news, skits, jokes, and other fun items. Other products are talking books, Braille and PrintBraille books, descriptive videos, and a music library.

(http://www.cnib.ca/library)

Talking Books and Technology Outputs

The introduction of digital technology in the production of audio and video materials has led to a revolution of talking books. The DAISY (Digital Accessible Information System) Consortium has reported moves towards the integration of DAISY standards for talking books into mainstream ebook standards such as the Open eBook Forum (OeBF). The DAISY Consortium strive to keep accessibility issues to the forefront of ebook developments and feel that as long as the disability community participates in the OeBF's activities, accessibility concerns will be honoured (http://www.daisy.org).

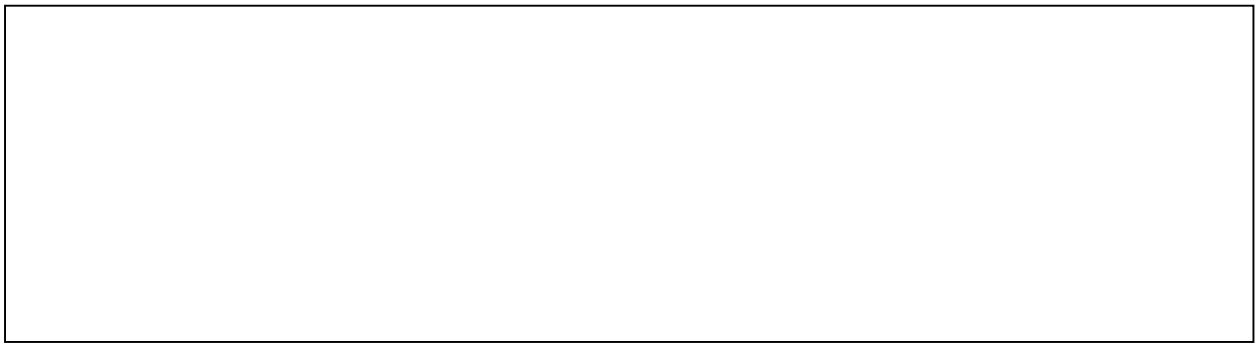
Braille print was one of the earliest Assistive Technology output options for the blind and still remains very important. The newer technologies have opened up parallel alternatives. The keyboard is the main input device for vision-impaired students. It may be advisable to introduce large keyboards with high contrast letters and coloured "bump-ons" to help locate hot keys. These tactile bumps on selected hot keys can help the novice find the correct stoke keys to activate screen reading software.

Output options for the visually impaired could consist of:

- Visual display, through monitor or magnifier screen,
- Synthesised Speech from the computer
- Printed material (large print)
- Tactile material – Braille
- CCTV (close circuit television)

Microsoft Windows Accessibility Options offer some help for display settings. It is possible to increase the font size for Window title bars, menus and other features, use a screen magnifier, increase the icon size, increase the colour contrast of the screen and change the colour to contrast black, white, and change the colour and size of the mouse. Sound signals may assist the user, by providing an audio signal when various computer operations are performed. These can be customised from the Control Panel.

There are huge amounts of resources on line where teachers can download fact sheets on how to introduce AT to persons with disabilities. These sheets usually guide the person choosing the AT application and raise issues that are common to the disability groups. AbilityNet (www.abilitynet.org.uk) is one resource that provides a series of fact sheets and skill sheets including some on vision-impairments.



Software, such as *Zoomtext* (see Annex 4 for more details) allows sections of the monitor to be enlarged to varying degrees of magnification. Screen-reading software with speech synthesisers can provide supplementary speech support to standard software applications (See Annex 3 for more details on screen-readers). There are also free downloadable versions of screen magnifiers and readers available on the Internet.

Standard texts can be scanned and transferred to disk to be stored or read by speech output. Used in conjunction with an optical character recognition program, it is most successful with clearly typed documents. But generally, it will not recognise handwritten notes. Once the document has been entered into the computer a person can choose to translate it into Braille format, listen to it being read out by the computer or read it in large print from the screen.

Technological innovation has enabled the transformation of print-based educational materials such as textbooks into flexible digital formats. Unlike print, where one size supposedly fits all, digital media can be adjusted for different learners. The nature of digital media provides flexibility and versatility that allows for multiple representations and multiple ways to interact with content. Digital text has the potential to provide greater accessibility to content.

The following examples highlight the development of Braille materials and talking books. One organisation that provides production facilities for Braille and talking books as well as planning, financing and setting up services within public, academic or special libraries and schools is FORCE. It seeks cooperation with one or more organisations which form part of a large, international network of partners active in similar arenas. One of FORCE's leading members is the Africa Braille Centre in Nairobi, Kenya.

Africa Braille Centre (ABC)

Founded in Nairobi in the late 1980s as Sight Savers International's African Braille Computer Development and registered about two years ago as an independent Kenyan NGO renamed as the Africa Braille Centre (ABC). ABC is primarily a computer producer of school textbooks but is developing a wider mission to embrace communication support for the visually impaired.

Within this remit it is, for example, providing training in Perkins Brailler maintenance and is interested in promoting the use of screen reader technology. ABC is soon to receive six Braille which will allow vision-impaired students to write in Braille and produce an ink print copy for a classroom teacher. Alternatively, the teacher can produce Braille notes and question papers that can be achieved with a low cost personal small Braille embosser.

ABC is also a leading member of the Force Foundation's Anglophone Africa Library network.

http://www.f-force.nl

The Irish Braille Production Centre

The National Braille Production Centre in Dublin is housed on the premises of a school for children with vision impairments. It was set up in September 2000 and is the only Centre in Ireland. It produces transcriptions of education materials into large print, Braille and tactile diagrams. It also provides materials in text-only format on computer disk and transcribes exam papers for secondary exams. The transcription services are free and the National Braille Production Centre works closely with students, parents, teachers and other organisations.

The Braille Production Centre has a team of people working on the translation of school textbooks into Braille. It uses Duxbury Braille Translator (DBT), which allows them to create highly accurate Braille schoolbooks and teaching materials. It has three Braille Embossers housed in a separate room. These are linked to the computers in the first suite. It has 96 children on its books and hopes to provide for 150 users in 2 years time (2005). The Centre also relies on a team of 30 volunteers to scan the books, pre-edit them and send the text files. Transcriptions are done in accordance with copyright permission.

http://www.stjosephsvi.ie

Celia Library for the Vision Impaired and Tactile Books

The Finnish Library for the Visually Impaired in Helsinki serves the visually handicapped and others with reading difficulties throughout Finland. The library produces and supplies specialist materials such as talking books, Braille books, electronic books, tactile books and relief picture material. The library, which is used by more than 10,000 customers, also acts as a central lending library for special materials for local libraries. The purpose of the Library is to give the visually impaired and others who are unable to read an opportunity to create for themselves a wide-ranging concept of the world, to obtain pleasure, information, and to study.

One of the most innovative set of books are produced by Anneli Salo, who works at the Library; these are tactile books made of felt, ribbon, plastic and other pieces of material. It is also of great importance that tactile books contain texts in Braille. Sighted children see all kind of texts everywhere. The only possibility for young visually impaired children to see their own kind of writing before school age is the Braille in the tactile picture books. Some children are so interested in Braille that they learn to read even before going to school. The Finnish children begin school at the age of seven.
http://www.celialib.fi/english.html

Digital Talking Books

The Swedish Library of Talking Books and Braille (TPB) collaborate with local libraries to allow people with print handicap access to literature. TPB is entirely government funded. The object of TPB is to produce and lend talking books, e-text books and books in Braille format. TPB also acts as an advisory body providing advice and information on matters concerning talking books and Braille. For many years, the production of analogue talking books has been the day-to-day work of TPB.

The first recording system 'Daisy Recording System' was used in the spring 1996 and TPB started to produce talking books in the new digital format. Lars Sonnebo from TPB describes what happened next "several test groups were formed with students using the books with the playback software called 'DAISY Playback'. The advantages of using a digital medium became immediately obvious. The students were quick to utilise the search and retrieval facilities and we were delighted that so much information could be contained on one CD".

http://www.medialt.no/datakortet/daisy/tips_tpb.htm

3.2 Assistive Technology for Hearing Impaired/Deaf Individuals

Deafness has been referred to as “the invisible disability” – as deaf people are not easily identified as disabled, showing no outward signs that they are any different. People with hearing impairments might be able to hear some sound, but might not be able to distinguish words. People with this type of hearing impairment can use an amplifying device to provide functional hearing. Other people might not be able to hear sound at all. There are no specific assistive technology products for people who are deaf or hard-of-hearing because they can easily interact with computers as long as they can choose to receive information visually or adjust sounds and volume to meet their hearing needs. Sound options are built into Windows, making technology accessible to people who are deaf and hard-of-hearing. It is important that technology is complementary to other strategies, such as sign language. Sign language is commonly taught on a one-on-one basis so that hand forms, facial expressions, location of hands and eye gaze can be learnt together. To learn a sign language you need to attend classes with a qualified Deaf Tutor who will demonstrate gestures and facial expressions and correct your mistakes. However, books with photographs or drawings of signs, videos or CD ROMs are useful for private study if you are already taking sign language classes.

A **loop system** is designed to cut out background noise for people with hearing difficulties. The “loop” is a wire that picks up sound from a microphone and transmits it to an earpiece, or hearing aid, within a loop. A cinema may have a very large loop, while a student in a classroom may wear a neck loop that will pick up the teacher’s voice, transmitted from a microphone. Loops are increasingly being installed in public areas such as cinemas, banks and public telephones.

Radio Aids

A radio aid consists of a transmitter and a receiver. The students wear the receiver connected directly to the hearing aid or via a personal neck loop (“T” switch) and the teacher wears a microphone and a transmitter. The radio aid can also be used with cochlear implant processors. The radio aid can assist students receive clear speech as the speech filter in the radio ensures the receiving of the teacher’s voice and not the surrounding speech or noise.

Sign Language

Teachers working in Schools for the Deaf have traditionally taught deaf students through oral language. There has not been a push for teachers to acquire sign language training until recently. Having to grapple with spoken language without visual aids makes the learning experience much more difficult. National Associations for the deaf and NGOs are advocating the need for teachers working with the deaf to be equipped with sign language so that they can help reduce the barriers to

communication within the classroom. Sign languages develop naturally over the years, just like spoken languages. They are as diverse as spoken languages. Thus, Deaf people in different countries do not use the same sign language, but some sign languages are related to one another, just as some spoken languages are connected. African countries have traditionally used American Sign Language (ASL) to teach in schools. In spite of this tradition, deaf communities have created their own languages, which can be quite regional or used, say, across the UK. British Sign Language (BSL), for example, is recognised throughout the UK, so most people who learn BSL in one part of the country will know what others are doing in other parts of the country. 95% of deaf children in the UK are now taught in mainstream schools rather than in specialist schools for the deaf (Wareham *et al.*, 2001). What happens when children are taught a dialect or regional sign language? How does this impact their lives when they travel or enter employment? Schoolteachers encourage oral language instead of sign language thus placing those with hearing impairments at a significant disadvantage. Teachers should have a basic knowledge of the country's sign language so that the hearing impaired children can learn the letters of the alphabet and build a bank of useful vocabulary.

In many countries in Asia and the Pacific, Sign Language, Braille, and finger Braille (tactile sign language) have not yet been standardised. The teaching method of sign language also varies even among institutions. These are the reasons why the deaf sector in rural areas finds it difficult to acquire basic education. Without access to these standardised forms of communication, persons with visual and/or hearing impairments cannot benefit from ICT developments. They are deprived of the basic human right to language and communication in their everyday lives. There is a need to spread the use of International Sign Language where deaf users can share a similar vocabulary and be able to travel more independently playing a more participative role on the international policy making stage in organisations such as the UN, OECD or the World Bank.

The younger a student becomes deaf, the less likely he or she is going to use spoken language. Those born deaf have never heard the spoken word: theirs is a visual world, with visual communication. How useful is it to place them in a classroom full of students who are able to use spoken language as a medium of communication? There are usually only a handful of trained Sign Language Interpreters and they are rarely employed in a school environment. A Sign Language Interpreter can only interpret one person at a time. For those students who understand spoken language it should be possible to provide visual representations in the form of overhead transparencies and handouts.

Smartboards

The SMART Board or interactive whiteboard turns computers and projectors into a powerful tool for teaching, collaborating and presenting. With a computer image projected onto the board, you can simply press on the large, touch-sensitive surface to

access and control any application. Using a pen from the ***SMART Pen Tray***, you can work naturally at the board to take notes and highlight important information.

The ability to control the computer from the SMART Board rather than from a corner of the room can make the experience feel natural for both students and teacher in the collaborative setting of the classrooms, while at the same time provide real-time access to a variety of sources of information. The ability to write, copy and save information for later discussion, e-mailing it to students or posting it to the class website provides new opportunities for both teachers and students in the instructional process. At the same time, it provides teachers, who have varying levels of technology experience, with the opportunity to incorporate the use of technology into the curriculum. They can enhance the learning process in ways that are comfortable and non-threatening for them, yet at the same time enabling an evolving change in their curriculum and pedagogy. Table 2.0 presents three case studies of school experience using ICT for special needs children within the UK.

Table 2.0: Birmingham School for the Deaf, United Kingdom

Type of AT	The Experience
Using Interactive Whiteboards with Deaf Children	Staff and children at the Birmingham school for the Deaf are always keen to adopt new ideas and technologies, which may lead to an improvement in teaching and learning opportunities within the classroom. It is a special school, which aims to meet the needs of profoundly deaf children who have British Sign Language (BSL) as their primary means of communication. The bilingual philosophy, which pervades the school, addresses not only the educational and communication needs of the children, but also ensures that the children take pride in their cultural heritage as deaf Sign Language users. Deaf and hearing staff work alongside one another to provide a rich and varied curriculum, which is delivered bilingually. The advent of the interactive whiteboard offers another tool, which could be exploited to help achieve a better outcome for our pupils. It could provide a dynamic, visually appealing and accessible tool in the classroom. All pupils have BSL as their first language. BSL is a visuo-spatial language so their thinking and learning processes are wired differently. We need to take account of that in the way we organise the classroom and their learning experience. We need to find ways of presenting and exchanging information in a way that supports their way of thinking. We believe the interactive whiteboard is one tool- of many - that can do this. The purchase of a Smartboard 560 and data projector marked the beginning of the adventure! (http://www.bgfl.org/bgfl/activities/intranet/teacher/ict/whiteboards/index.htm; http://www.smarttech.com/products/smartboard/index.asp) A junior school and hearing impaired unit provide an inclusive environment for hearing impaired children who are educated through a natural aural approach. The children attached to the unit have a significant hearing loss and abilities that fall within the “average” range. The guiding principle that underlies their placement within the school is that they should be allowed to make the best of their residual hearing.

Type of AT	The Experience
	The children have full access to the national curriculum and are members of a mainstream class. Children have the use of specialist teaching resource facility. The school has paid attention to reducing internal noise by carpeting classrooms and some corridors. Most of the ceilings have some degree of acoustic treatment. There are no open plan classrooms within the Junior school. Attached to the main building is the hearing impaired unit, now named the Resource Provision for the Deaf. In one classroom, the teacher uses a sound field system and a personal radio fm system are used by one of the hearing impaired children who use a hearing aid. During group time the child sits to the left of the teacher. The teacher wears a radio transmitter that transmits her voice directly to the child's hearing aid and to the classroom sound field amplification system. This will ensure that she does not have to raise her voice and distort her speech. All children benefit and as a consequence are better able to participate. The school is constantly looking at ways of upgrading the acoustic environment of the school, seeking to lower the reverberation time. This assists in reducing noise during critical learning times of group work and class discussion. http://www.teachernet.gov.uk/_doc/3227/Section9.6.pdf

Virtual Reality Sign Language	The desire of young children, whether hearing or deaf, to communicate develops far sooner than the ability to use words. In addition, a child's spatial memory develops quicker than textual memory, making British Sign Language (BSL) an ideal means of early communication between young deaf children and their parents. A high degree of BSL proficiency is not required for this to occur. A knowledge of even a few easy signs for simple ideas and everyday objects will help these parents to form bonds and encourage positive behaviour with a deaf child. Some learners find it difficult to follow written instructions of how a sign that moves is formed. The linear presentation format of video does not allow searching or one-touch playback of individual signs. Video equipment may be difficult for children to use. A CDROM resource called "The BSL Dictionary Project – virtual presenters of sign language" has been developed by a partnership of Scottish organisations to provide the parents of deaf hearing-impaired children with a tool that helps them to become more involved in their children's language acquisition. By using high-end computer graphics within an intuitive interface, the BSL Dictionary is fun to use and easily accessible for both children and adults. Teachers of the deaf and families with deaf children have a resource with animated presenters with whom the children can relate to. There is a cast of four "virtual" children who have been specially created to perform the signs in the dictionary. The "cool" factor attached to learning through animation will encourage child signers to use the animated CD ROMs rather than watching "live action" adults on videotape. http://www.ngflscotland.org.uk/files/sen36.pdf

3.3 ICT for General Learning Disability Groups (*Mentally Handicapped*)

This is the largest disability group and can be divided into a number of smaller groups ranging from mild, moderate to severe/profound and multiple learning disabilities. Within each of these groups there are children who have been diagnosed with one or more specific conditions or disorders. The matching of ICT for children who fall within this broad category must be undertaken with extreme care. Some of the disability groups that have benefited from the use of AT are children with speech and language impairments. In the past this group have depended on low technology assistive aids (e.g. pictures, photographs) to assist communication. These forms of low tech Assistive and Augmentative Communication (AAC) can work well with certain disability groups and not as well with others.

Some communication systems e.g. speech training, sign language and picture-point systems, are highly dependent on prerequisite skills. These skills involve pointing to or touching pictures or similar visual symbols. Typically, developing children learn each of these skills, in part, because of their associated social consequences. Very young children with autism are not highly responsive to these types of rewards and thus training protocols must include non-social rewards. If we work from a model where a child with the speech impairment initiates a communicative act, we must look for a reliable and consistent system that will enable the child's success. This can be done by means of careful assessment by a multi-disciplinary team in the form of an AT Assessment. A full AT assessment is an important starting point when deciding on what device to introduce to a child. There are a number of steps that should be taken to ensure that the correct piece of technology matches the individual.

There are a variety of "*Guidelines for Assistive Technology*" that can be downloaded from the Internet. These assessments should always be carried out by professionals who have a clear knowledge of the individual's cognitive skills, physical skills (gross and fine motor), communication skills and have a clear aim of what is to be achieved. Personnel who would be able to contribute to the assessment are Occupational or Physical Therapists, Speech and Language Therapists, Fully Qualified and Experienced Special Needs Teachers, Clinical Psychologists and Technology Engineers experienced in dealing with switch operable devices and communication aids. The individual or client should always be consulted during the process in order to avoid any potential rejection or abandonment of the technology. Guidelines for AT, record keeping and an AT Considerations Worksheet are available in pdf format from "Hands-on Assistive Technology" (http://www.teleschool.k12.hi.us/hoat/resource.html).

The majority of students with mild general learning disabilities should be able to use standard, commercial ICT equipment and software with appropriate support. Some may need assistive technology ranging from tracker ball (a mouse with a large ball in the middle) or more specialised software for those diagnosed with Specific Learning

Difficulty (SLD) or dyslexia (e.g. word prediction programs). ICT has much to offer in order to assist the student in the completion of tasks at varying levels of difficulty. By engaging the students, ICT can help extend their attention span and motivation levels. With the correct input from ICT, students with mild learning disabilities can access a significant portion of the school curriculum.

There is a plethora of software aimed at children who have mild learning disabilities. (See Annex 5 for a list of reputable suppliers). The effective use of good quality and appropriate software can enhance students' self-esteem, improve their concentration and stimulate interaction with their peers. Teachers should become familiar with the programs and read evaluations on tested software before introducing them into the classroom. The Irish National Centre for Technology in Education (NCTE) has created a database of software that has been tested on students with *mild learning disabilities* in primary schools throughout Ireland. This guide produced by the NCTE in collaboration with TEEM (Teachers Evaluating Educational Multimedia) is designed to assist teachers in making informed decisions about educational software. It provides information on selecting and evaluating software for use with students and includes a section on evaluating software for special needs (http://www.ncte.ie/).

Moderate/ Severe and Profound General Learning Disabilities

Special Schools often provide education for children who fall into this group. There are initiatives to provide linkups with mainstream schools so that some children have a limited amount of access to mainstream education. This can be on a once a week or daily basis depending on the level of acceptance by staff and school managements. ICT can provide a helpful bridge for children with *moderate general learning disabilities* through the use of communication aids and switch devices. There have been a number of successful projects where children with *moderate general learning disabilities* have been able to participate in lessons using a switch operated software program.

Young children have traditionally enjoyed listening to and learning nursery rhymes. Teachers have taught the rhymes during group or circle time right from early start pre-school through to Junior School. There is a whole range of rhymes varying in difficulty that can be used in conjunction with a switch-operated software. One of the most successful switch operated literacy programs is "Clicker" (Crick). Clicker is supported with high quality speech, and is easy to customize for individual needs. It also has a wide range of accessibility options for users who cannot use a mouse or keyboard.

Playing Bingo with Clicker

Using a familiar game of Bingo, Terry Hill at Severndale school in England provided a useful reinforcement exercise for number recognition and matching skills. Each pupil was given a bingo card Clicker Grid that featured a set of random numbers from 1-30. Pupils were then required to match numbers on their grid to those being displayed by the 'bingo caller'. The numbers on the Clicker Grid are generated randomly by the use of a mouse click or single switch, enabling a switch user to generate the number before then matching the numbers on their bingo cards. Terry Hill observed, "By turning a routine but necessary piece of teaching into and enjoyable activity, the children were highly motivated. They were able to strengthen their turn taking skills, extends their concentration spans as well as consolidating their number recognition and matching skills. A simple but highly effective way of using Clicker to support existing classroom practices." (http://www.learninggrids.com/us/)

Clicker has proved to be a successful learning aid in a school for “Learning Difficulties” in Cape Town, South Africa where it is used with a child who has atheoid cerebral palsy. There is a pictographic BLISS option (a form of Esperanto sign language) and the possibility of using a wide range of switches has helped the child communicate with his teachers and family. This software has been used by speech and language therapists in the developing world and has won several awards for its excellence and versatility. Few software programs for children with SEN are as reliable as Clicker and as all encompassing; meeting the pedagogical, communication and social skills that these children require (Brandjes April 2002).

One of the obstacles to introducing British or American software is the cultural bias they have towards the northern countries. By introducing too much non-African culture software into Special Schools we are reducing the impact it has on the children’s learning. Educationalists would vouch for a curriculum that has “meaning “ for a student with SEN---one that draws on the student’s background and knowledge. Content-free software, including Clicker to a certain extent, does not cause the cultural barrier that many content-rich programs would. It is therefore important for research to take place in Africa to see how African software suppliers can furnish the continent’s markets.

Suppliers play an important part in the promotion and selling of new AT and software. There are very few suppliers or vendors operating in Africa who are willing to promote Special Educational Needs ICT or AT. One of the major barriers to the promotion of specialised software and high technology devices is the cost of manufacturing and importing them. Many devices have to be ordered in very small quantities and fitted by experts. This can be very costly for already strained school budgets and can take up to 3 months to be delivered. It is essential that African Special Educational Needs Divisions, with the support of Education Department and Ministries, work to reduce the costs of AT and software so that individuals who badly need the devices have them fitted or installed onto a school’s computer. Negotiating reasonable prices with suppliers for devices for African countries which can be a fraction of the price paid in

Europe or North America is a strong recommendation for parties involved in the ordering and distribution of software and hardware in Africa.

The following table describes a few examples from a non-Africa context based on experience of ICT in Special Educational Needs schools from around the world.

Table 3.0 Examples of Non-African Experiences of ICT used in Special Schools. Based on Internet Search for Imfundo ICT/Special Needs Study, 2003.

Country	Experience
Jordan	In **Amman, Jordan**, the **Hadi Institute** is providing deaf and blind students with the opportunity to learn and communicate through methods as simple as sign language and as complicated as computer technology. The Institute runs several schools, the Rajaa School for the Deaf, the Hope School for the Deaf, and the Nour School for the Blind. The schools use primarily low-tech tools, such as Braille-printed elevators and red and green lights in the classrooms that tell the children when to pay attention and when class has ended. The Institute also has 10 computers, all equipped with assistive software for blind and deaf students, as well as a Braille printer. This equipment provides important communication opportunities for the students, many of whom were isolated without any form of communication before coming to the Institute.
Kuwait	The **Kuwait Institute for Scientific Research** has been working for many years to meet the needs of the blind in Kuwait and throughout the Middle East. In 1986 they developed an English/Arabic Braille word-processing system, and they have since then used it to create Braille textbooks, among other printed products. As computer technology became more important, they also developed a Braille computer for the blind, adapted to Arabic. Several computer programs, including a Sign Language Dictionary, have been established in Kuwait Special Schools, and Braille printing facilities have been established in at least 15 schools throughout the Middle East. (http://www.kisr.edu.kw/search.asp)
India	In **India,** 10 schools serving more than 300 visually impaired students in Andhra Pradesh have been provided with multimedia computers, JAWS software, open book, OCR reading software, and a Braille printer by Freedom Scientific, a U.S.-based company. (http://www.unesco.org/bangkok/education/ict/ict_enabling/ict_use_overview/analysis.htm)
Israel	The **Net-Shema Project,** carried out in **Israel,** where many hearing impaired students are integrated into standard classrooms, provides an Internet-based support system for hearing impaired students, allowing them to communicate with one another as well as with people with normal hearing, creating increased understanding. The website provides a forum for discussion among students, teachers and parents, as well as medical information, a sign-language dictionary, a gallery of artwork by hearing impaired students, and useful links to websites providing further information about hearing impairments and learning tools for hearing impaired students. (http://netdays.org.il/pr2000/p004.htm)
United States	In the **United States,** the state of Arkansas's **Increasing Capabilities Access Network** provides assistive technology services for students throughout the country, including 6 technology assistance centres, specialising in different areas of assistive technology: blind and visually impaired, speech and audiology, life styles, independent living, independent case management, and resources (http://www.icdri.org/index.html)

3.4 Students with Physical Disabilities and ICT

The integration of students with physical disabilities into any school setting requires substantial planning and good will. The first question any head staff should consider is whether the school is structural built to wheelchair or frame standards? This will include all aspects of the building including the toilets. Second, they should ask how can the student be integrated into the environment without feeling an “outsider” or “hindrance” to the rest of the class? A third question is what materials and resources will the student need to access the curriculum and be able to interact with his or her peers easily? These questions should be dealt with so that the physical barriers are reduced and learning can take place. A safe, comfortable learning environment can help reduce anxiety and low esteem often suffered by students with physical disabilities. Schools should not be expected to take on the responsibility without seeking advice from architects and occupational therapists.

Students who use wheelchairs or specialised seats have to be considered when purchasing furniture (e.g. adjustable trolleys) to hold PCs. Non-specialists may not appreciate the importance of measuring the height and length of furniture so that children in wheelchairs can reach the keyboard and mouse. The presence of a sound ergonomic environment where a child can easily access a computer cannot be understated. We must remember that students with physical disabilities tire quickly, especially if the seating and positioning are incorrect. Good ergonomic practice results from careful planning with a certain amount of trial and experimentation. There are a range of specialised tables, footrests, arm supports available from specialist computer hardware suppliers.

Children in wheelchairs using switch operable devices may find it easier to have them connected to their arm-rests with a piece of Velcro or mounted onto a board/tray or an adjustable mounting arm. Even using two hands for a keyboard can be extremely difficult for students who have problems using both hands. One-handed keyboards with smaller keys could enable a student to move around the keyboard quicker and type for longer periods.

It is worth purchasing large monitors, as some students in wheelchairs or specialised seats are sometimes further away from a monitor. It is important to position an individual correctly so that his or her visual contact with the monitor is slightly below eye level. It is not recommended that monitors be positioned where the individual has to stretch his or her neck.

Students who have severely crippling disabilities may not be able to touch a keyboard or mouse and will have to be equipped with a switch placed on their body (e.g. knee or

chin). Those with paralysis from the neck downwards may only be able to move their head up and down or jerk their knee against the other one. It is possible to attach specially adapted switches to parts of the body that are able to move, thus enabling the student to communicate a message or scan a computer screen. One of the most successful uses for switches is the activation of communication aids. Students who are unable to move their hands can press an external switch (e.g. adjustable pressure switch, touch switch, suck / blow switch) with another part of their body to select and say a message from a communication box. Students who have some hand movement could benefit from a joystick as it is much more adaptable to sudden jerky movements. There are a number of suppliers that deal specifically with access devices in the UK. One leading supplier of innovative products can be found at www.QEDLtd.com.

There are examples across the world of schools working with individuals with severe physical disabilities with the aid of assistive technology. The question to ask is "How committed are Ministries and Departments of Education in providing adequate funding so that these children gain the rightful access to education?

We should also not forget the young people who have been victims of brutality, as they had to choose to have limbs amputated as an alternative to being shot. Sierra Leone is one country where a rebel attack on Freetown caused severe destruction to 70% of the homes and other buildings in the community. Education Projects including the Lifelong Development Organisation are working with communities to rebuild essential learning skills that have become so severely disrupted as a result of the conflict (see the Box below describing the Nehemiah Project for War Affected Children).

The Nehemiah Project – Working with children affected by war

Computer and information literacy skills are very much in demand worldwide and in Africa, where there is a need to close the digital divide; such skills are increasingly sought not only by local clients but also international clients.
Having ICT skills will open the door not only to provide beneficiaries with employment opportunities but also to narrow the skills gap in ICT as this country rebuilds its economy. There are many organisations, including Lifelong Development Organisation, that are working with these victims to give protease and teach them how to lead normal lives again.

This initiative will complement these efforts by also providing them with skills in IT.

- The social impact of this initiative will include the:
- Creation of new employment opportunity;
- Creation of employment and income for disabled people;
- Creation of social cohesion by reducing disparities in society;
- Enhancing self dignity;
- Empowering people to participate in the global economy

http://www.thenehemiahproject.org/projects/business.htm

4.0 The African Experience

4.1 Introduction

Internet based searches on the use of ICT in Special Educational Needs in Africa revealed that there is as yet very limited use of ICT. It is probable that activities are taking place which are simply not being documented on the Internet, but based on what is available, we can see that if Special Educational Needs are being addressed at all, this rarely includes the use of ICT. Based on our findings, we can still make certain inferences about the general use of ICT in Special Educational Needs in Africa.

In many African countries we find a very low level of infrastructure, low teacher motivation, and limited resources even in standard educational institutions. Therefore, it is not surprising that there are very few incidences of specific Special Education, and even fewer situations in which ICT can readily be integrated into such programs. Most countries are struggling to provide for their mainstream schools and Special Educational Needs support remains a low priority.

In general, we find that most ICT based educational activities are limited to Southern Africa, and South Africa in particular. With a well-established infrastructure and greater funding for education than other African countries, it makes sense that South Africa should be leading the way. However, while the country is making great strides in bringing mainstream classrooms online, activities are still limited in terms of SEN. Outside South Africa, we find a few isolated incidences of ICT use in educating students and adults with disabilities, specifically in Senegal and Ghana.

Many of the activities that are carried out are due to the actions of one dedicated individual, either a teacher, school administrator or student, who chooses to make things happen at their school. These individuals often establish linkages with other schools or organisations outside Africa, allowing for the creation of relationships between their students with special needs and other students with similar needs around the world or with mainstream students in their own communities. Linkages exist through programs such as School Net, Think Quest, the Achilles Track Club in New York City, and the Windows on the World North South program, financed by the Department for International Development (DfID) and run by the British Council.

Our Internet based search revealed that initiatives are beginning to bridge the gap between special needs students, who are often isolated within their communities, and students without disabilities, who often suffer from misconceptions about disabled

individuals. Providing students with links to other students with disabilities can also help alleviate their own feelings of isolation and improve their self-esteem.

There are a number of non-school based activities focusing on disabled individuals outside school. This is significant due to the lack of specialised education for students with SEN, as well as cultural attitudes that prejudice people against disabled individuals. As a result of these factors, many students with SEN never receive an education at all, and we can see the development of significant adult education courses in response to this need, in particular in Ghana (New Horizon School), Ethiopia (Adaptive Technology Centre for the Blind), and Senegal (BREDA Workshop.

For the vision impaired, there exists an organisation in Ethiopia that is trying to address the needs of individuals through technology. The Adaptive Technology Centre for the Blind (ATCB) acknowledges the lack of adaptive technology available in Ethiopia and hopes to improve the situation, specifically through improved Braille-printing technology and a computer training centre that would meet the professional and educational needs of Ethiopia's visually impaired community. The Ghana Society for the Blind is also lacking in screen reader software but does have low and medium technology devices for use) (see also Box on Africa Braille Centre in Nairobi).

Although the desk-based research revealed little specific information on education for the hearing impaired, first-hand contacts made with the Ghana National Association of the Deaf suggest that they are interested in developing the use of sign language for the hearing impaired in Ghana. Many African Sign Languages are based on American Sign Language (ASL) and have evolved over the years. Even though ASL is understood in African countries it still only has limited application. There is real potential for the development of appropriate digital learning materials for improving the spread of signing language across Africa.

Students with general learning disabilities are the most widely addressed Special Educational Needs group in South Africa, as is shown in the case studies below, and they are also the focus of a handful of special schools in Ghana. However, there exists a need for greater attention to be given to students with a range of learning disabilities, and it is important that all schools continue to increase awareness about learning disabilities and *mentally challenged students*.

African Government Lessons Learned

In considering the use of ICT in Special Educational Needs in Africa, the first step must be to determine what is feasible based on a country's funding, infrastructure and capacity for maintaining equipment. Low and medium-tech devices are the best entry point for most countries, particularly those with limited computer resources and Internet

capabilities. It must be recognised that outside capital cities, it is highly unlikely that African countries will, in the immediate future, be able to support strong information infrastructures, or be able to maintain these infrastructures, which frequently break down even in developed countries. Even large-scale projects such as the Leland Initiative, carried out from 1995 to 2000 by USAID, in an attempt to provide complete Internet connectivity to 20 African countries, experienced only limited success due to the challenges presented by weak infrastructures in most African nations. Experiences show that small-scale projects have better success, and in terms of education those are usually specific initiatives put forth in individual schools with specialised focus and knowledgeable and motivated teachers.

As an entry point, low-technological options should be implemented first with sufficient training for teachers and students so that they can be integrated into the classroom environment effectively. If these are received well, funding might be provided for an increased level of technology to be implemented. However, it is most important to focus on what is feasible rather than jumping forward and aiming for the most advanced, up-to-date equipment. Beyond the question of technology itself, little will be accomplished until there is a wide-scale appreciation for the importance of Special Educational Needs and the inclusion of people with disabilities into mainstream society.

Clearly, teacher education is an important aspect of the drive to improve ICT use in SEN. In Ghana, most of the special schools that are using ICT have international volunteers who provide the necessary instruction for students and other teachers. ICT needs to be integrated into the teacher training process (particularly Special Educational Needs Teachers) before it can be fully implemented at the student level.

4.2 Good Practice in ICT and Special Educational Needs in Africa

Since the integration of ICT into Special Educational Needs is still in its early stages in Africa, it seems more appropriate to refer to “good practices” rather than “best practices.” This study has revealed that there are indeed positive examples, which can inform future initiatives by African governments and organisations.

Good practices involve students in a participatory style of learning, which not only informs them but also strengthens their self-esteem and their ability to participate in the real world as well as the academic world. It is vital that students be equipped with the life skills that they are to face in the outside world. ICT training will provide them with a wide range of employment opportunities in the future provided they are given the required exposure and training during their schooling and rehabilitation. Furthermore, as discussed earlier, the use of ICT can assist students in communicating with their peers and with others outside their peer group, opening up avenues of expression that

might otherwise not be explored for students with SEN. Examples of this kind in Africa include the use of computer art programs and the Internet at the Ningizimu School in South Africa, and computer literacy and home economics training at New Horizon School in Ghana. These programmes do not necessarily require very high-tech equipment but involve making the most of whatever is available and building on the knowledge and expertise of volunteers.

4.3 Special Schools

One of the most promising cases of the ICT integration in special schools is related to teacher in-service and professional development. By far the greatest movement in ICT for students with Special Educational Needs is in Africa with some integration programmes. South Africa is ahead of most Sub-Saharan African countries in terms of infrastructure and the educational system. It is not surprising that it is also further advanced in the use of ICT in education as a whole and in Special Education in particular. *School Net South Africa* and the *Acacia Initiative* are just a few of the ways in which the country is taking strides towards incorporating ICT into all of its schools.

A particular bright spot on the South African landscape is the Ningizimu School for the Severely Mentally Handicapped, in Durban. The majority of the school's students live in poor conditions in the surrounding townships, but Robin Opperman, the head of the Art and Technology Department at Ningizimu, has made sure that his students still have every opportunity to do meaningful work and to use the Internet to connect them to the rest of the world. In 1996 the school initiated an art competition known as the A4 Art Exhibition, with the idea that all artwork submitted must be A4 paper size. The goal of the project was to create dialogue and understanding between Special Needs Schools and mainstream schools. Since then the exhibition has flourished, and now includes a website where Internet users can view student artwork and learn about projects being carried out by the school's students in conjunction with students in foreign countries such as the U.S., Jamaica, and Norway. The website encourages dialogue and debate, provides the students with a powerful mode of communication, and, perhaps most importantly, educates people about the amazing capabilities of the Ningizimu students. The Think Quest challenge below demonstrates just how valuable linkages through the Internet can be.

Ningizimu Special School in South Africa

Perhaps the most inspiring part of the Ningizimu story, focuses on one student, Sizwe Ngcobo. In 1999 Mr. Opperman helped Sizwe to become part of an international team of students working on the ThinkQuest challenge on the Internet. ThinkQuest is a non-profit organization in the United States that runs programs and competitions on the Internet for students from all over the world. Sizwe linked up with Jason and Janine Yeo, a brother and sister team in Singapore, and with the help of Mr. Opperman (who translated all correspondence between the Yeos and Sizwe, who speaks only Zulu) the 3 of them created a resource project called "The Passing of a Century," which presents an impressive amount of information about the Twentieth Century. A Special Needs student had never before participated in ThinkQuest, but after the Yeos contacted the organizers, Sizwe was approved on the project began. Not only did Sizwe actively contribute to the creation of the site despite having no access to a computer, but the project also features a variety of artwork done by other students at the Ningizimu School.

"The Passing of a Century" went on to win a Silver Medal in the ThinkQuest competition, and earned the 3 students a trip to Los Angeles in the U.S. where the Yeos and Sizwe met for the first time and they all received their award of US$1,000 for each of their schools. The Ningizimu School used that money to buy their first computer. Sizwe now works as a supervisor in the school's art classroom, working particularly with the Paintbrush program to create artwork on the computer. Since then another Ningizimu student, Siyabonga Dangwane, has participated in ThinkQuest as well, using the Internet to tell his story of "Living With Autism" to the world.

Ningizimu A4 Exhibition Website: http://users.iafrica.com/a/a4/a4exhib/index.htm
"The Passing of a Century": http://library.advanced.org/27629
"Living with Autism": http://library.thinkquest.org/C0110296

There are several other examples from South Africa, which highlight the diversity in how ICT is being used. For instance, technology grants of $1,500 provided to a group of South African schools by Electronic Data Systems (EDS), a U.S.-based global IT services corporation, have allowed the institutions to acquire computers, printers, and other ICT products. One of the schools to receive a grant was the **Meerhof School** in Hartbeespoort, near Johannesburg, which used the money to acquire hardware to be used by 8 disabled students, purchasing a computer with an adaptable mouse and keyboard. Such materials enable the students to communicate freely and to express themselves in ways that are more productive and build up their self-esteem. Lona Liebenberg, the teacher who won the grant, stated: "An adapted computer enables the disabled learner to interact with his or her environment and to develop from a dependent to an independent individual. The severely disabled learners are often underestimated as far as their abilities are concerned. Only when communication, through adapted aids, has been made possible can they develop to their full potential."[10]

[10] Maxwell, Dawn. "EDS Grants Boost Technology in South African Schools." http://www.eds.com/about_eds/homepage/home_page_south_africa.shtml

The **Ethembeni School**, located in Hillcrest outside Durban (South Africa), enrols over 300 physically disabled and visually impaired students. Through a relationship with the Achilles Track Club in New York City, which involves disabled children in running and other athletic activities, the South African school has received a donation of computers and other adaptive equipment that will be used to further a linkage between the school and the New York organisation. The Ethembeni School has recently changed its curriculum emphasis from being purely academic to focusing on how the students can be helped most practically to prepare them for real life situations. The provision of ICT equipment will make this technical training easier and more appropriate, providing the students with post-schooling opportunities they would not have otherwise had. Meanwhile, the Achilles Club created a link between the Ethembeni School and the Lavelle School for the Blind in New York, so that the students at the two schools can communicate via e-mail, letters and a website. Groups of students from both schools participated via the Internet in a variety of collaborative and interactive events that gave them the opportunity to learn about each other's lives and cultures.

At the tertiary level of education, the **University of Cape Town, South Africa** provides students with a wide range of assistive services and equipment. The school's Disability Unit (DU) is active in providing for the needs of disabled students on campus, through such services as Braille embossing and the transcription of academic materials as well as a Computer and Assistive Technology Laboratory containing six computers equipped with voice synthesis technology. The DU also works to improve the physical accessibility of the campus, and assists students with disabilities when they are unable to reach a necessary part of the school, providing temporary wheelchairs, ramps and other electronic equipment as needed.

Special schools in Africa can be enhanced through the use of ICT for their students. The challenge is to find sustainable and cost effective measures, which bring technology into the classroom and ensure its usage and maintenance in order to enhance the teaching and learning process for the student. Teachers, speech and language therapists and other practitioners working with students functioning within the severe range of learning disability are beginning to see the positive changes that AAC devices are making on students' communication and learning. Greater dissemination of good practice in special schools needs to be more widely shared between practitioners so that students with similar disabilities have an equal chance of accessing the technology.

4.4 Teacher Education

Very little was found in Africa regarding ICT at teacher training level for Special Needs Teachers. Open and Distance Learning programmes developed across the continent for teacher education afford an excellent opportunity for ICT support and integration. Low-tech assistive technology should also be considered in order to enhance teaching

learning and instructional methodologies. One promising centre, which was founded for assisting the blind, is in Ethiopia (see Box below).

Adaptive Technology Centre for the Blind (ATCB)

The **Adaptive Technology Centre for the Blind** (ATCB) in **Ethiopia** attempts to provide computer training and Braille transcription services for visually impaired students and professionals in Ethiopia. Although not a school, the goal of the ATCB is to fill in the gaps in terms of assistive technology for visually impaired individuals. Their objectives include the establishment of a computer-training centre and the acquisition of computers and other equipment such as magnifying hardware-software and speech synthesisers for use at the centre and by individuals.
http://www3.sympatico.ca/tamru/

The Internet can be an excellent source of information for teachers working in the field of Special Educational Needs. The Internet allows teachers to keep abreast of the latest developments. One of the first Institutes's for Autism in Africa was opened in Ghana in May 2003. The centre is based in one of the private schools for general learning disabilities in Africa: New Horizon Special School (see Box below).

New Horizon Special School, Accra, Ghana

New Horizon is a school for children and youth with intellectual disabilities, providing basic academic education for over 90 students ages 4 to 17, and also providing vocational training in the form of sheltered workshops for another 50 individuals, ages 18 to 40. The academic branch of the school provides education in language development, numeracy, music, arts and crafts, daily living skills, physical education, introduction to vocational skills, and computer literacy. A computer lab with 10 computers and a few assistive devices (e.g. joystick) is provided for student use. The school utilises software that helps the students to develop their cognitive abilities. The school is connected to the Internet and thereby provides research information and establishes computer linkages with worldwide institutions.

New Horizon is also home to a Resource Centre for Autism. The Centre is providing support and training --introducing software and ICT-based solutions for teachers in Ghana. With the use of ICT already integrated into the school curriculum, this Centre provides an opportunity for further utilisation of assistive technology for those students who have difficulty communicating and interacting (http://international.egmont-hs.dk/nhss).

4.5 Inclusive Education

There were very few examples of how ICT is assisting Governments move towards inclusive educational policies within the African context. Two main approaches appear to be emerging on a very small scale:

- children with Special Educational Needs are interacting with mainstream children through the use of ICT and internet accessibility (see ThinkQuest programme)

- some mainstream teachers are beginning to learn about Special Educational Needs children through the use of ICT (UNESCO deaf video pack etc).

It is unlikely in the near future that high technology for individual children in Africa will reach the proportions that western children are exposed to. The only hope is for telecenters or for community centres of learning to reach out as much as possible to the needs of children within their environments. One such project which is truly "bridging the gap" and shows tremendous potential for assisting children with Special Educational Needs to move into the mainstream and become productive citizens is happening: "after school" within a life long learning environment.

One example of meeting the material needs of vision-impaired students at school is through a partnership between the Uganda National Institute of Special Education (NISE) and the Danish International Developmental Agency (Danida). The Institute also provides teacher training in special education and rehabilitation (see Box below).

Uganda National Institute of Special Education (NISE)

The Uganda National Institute of Special Education (UNISE) was established in 1991 with the financial and technical support of the Danish International Development Agency (Danida). It has recently set up a Braille Press to produce textbooks for the nations schools.

The Sector has two departments namely:
1. Information and Publishing Department which includes; Editorial, Graphic Design and Audio/Video Sections.
2. Educational Materials Department which includes; Materials Production Workshop, Braille Production, Low Vision and Sign Language Section

http://www.unise.ac.ug

The training of post-school persons with vision-impairments can be witnessed at the "Computer Learning Centre", set up by the Ghana Society for the Blind and Sight Savers International. The Ghana Computer Learning Centre is equipped with 8 computers and is teaching the vision impaired basic typing skills with the aid of synthesised voice software thus helping them to enter the work force.

Additionally, the World Blind Union's (WBU) International Development Partners (IDP) is working alongside some of Africa's National Membership Organisations of Blind People as they set up computer screen reader training laboratories. Amongst these are the Uganda National Association of the Blind in Kampala and the Ghana Society for the Blind in Accra. In both cases IDP has been assisting in bringing alongside them international stakeholders like Freedom Scientific and the CIDA funded volunteer programme. In both of these cases Sight Savers International's (SSI) country office has provided a consignment of recycled British Corporate computers (http://www.cnib.ca/eng/about/organization/wbu/).

5.0 Challenges and Opportunities for ICT and Special Educational Needs in Africa

5.1 Introduction

This section focuses on exploring the key issues which should be considered by African Governments when they are considering the use of ICT within the Special Educational Needs sector. With the new information highway and the digital explosion taking off in the Western world, African Governments are faced with the stark reality that ICT can provide the potential to kick start areas of the education system which have remained under-resourced and have lost many of their human resources due to the loss of trained teachers to illness or other non-teaching professions. Tertiary and senior secondary levels of education hold particular promise for ICT in countries where libraries and the core set of teachers are not available to teach students. It also allows these systems to expand to the ever-increasing demand for tertiary level education. For students with SEN who attain this level of education, software and hardware solutions will not be far out of reach. Today, there are increasing software choices that empower the student with a disability to produce the required assignments and course work. Again, access to the required adaptive technology should not be a privilege but a right. Posts for University Disability Officers should be created so that students with sensory impairments or physical disabilities can enter the realms of tertiary education with the required support.

The problem of integration and inclusion presents a wide set of challenges at the basic level. ICT will remain in the hands of teachers and child educators enhancing their ability to better perform the task at hand. Limited human and financial resources in Africa present particular challenges for the Special Educational Needs sector. The initial steps will, most probably, include using ICT as an educational system for the public and teaching community to enlighten them to the issues of students with Special Educational Needs and attempt to reduce the stigma still persistent in society.

5.2 Resources and Support for ICT and Special Educational Needs

Worldwide, a number of organisations have sought to capitalise on the disproportionate amount of Assistive Technology that exists in developing versus developed countries. In an attempt to meet the low and high-tech needs of people with disabilities in developing countries, organisations such as the **East West Foundation** (EWF) and **Whirlwind Wheelchair International** (WWI) provide both short and long-term solutions to the lack of equipment (see Box below).

Assistive Technology Recycling

Whirlwind Wheelchair International helps people in developing countries to build wheelchairs that suit their needs. The exportation of American-made wheelchairs often fails, as the chairs are in no way equipped for the uneven surfaces on which they are used overseas, and it is expensive and sometimes impossible to repair them or obtain replacement parts. WWI works to enable local designers to use easily available and inexpensive local materials to build wheelchairs that meet the needs of their users. The organisation then identifies successful wheelchair designs and communicates them to other countries where they can be implemented.

Contact Information:
Whirlwind Wheelchair International
Ralf Hotchkiss, Technical Director
East Bay Office and Workshop
6506 Farallon Way
Oakland, CA 94611 USA
(510) 547-2704

The East West Foundation takes advantage of the rapid overturn of computer equipment in developed countries to provide needed computer technology to developing nations. Initiated in the early 1990s to provide computers to former Soviet republics, the organisation now focuses largely on computer recycling within the U.S. However it still runs international projects in countries such as Kenya, Honduras, Nigeria, Senegal, Angola, and South Africa. EWF refurbishes computers and then gives them to organisations, schools, and non-governmental agencies for distribution. Training is also provided through community-based organisations, so that the computers are put to use.

Contact Information:
East West Foundation
Stephen Farrell, President
504 Dudley St.
Roxbury, MA 02119 USA
(617) 442-7448
http://www.eastwest.org

Computer Aid International

Computer Aid International aims to bridge this digital divide by refurbishing computers from the UK for re-use in schools and community organisations in developing countries.

On receipt of computers, volunteers in their workshop, test, refurbish and pack computers, ready for shipment. We have three workshops where there are three distinct activities:

Unit 1 - Storage of untested and recently donated computers

Unit 2 - Testing and refurbishing of computers

Unit 3 - Boxing and storage of refurbished computers awaiting shipment

(http://www.computer-aid.org)

Another promising area is the use of Open Source Software and Free Software (OSS/FS). Building awareness of the influence of OSS/FS and how it could help developing countries through a collaborative network of software technology tools should be promoted. This capacity of OSS/FS development can be built through the development of funding, a knowledge warehouse of expertise in African countries, development of regional and national OSS/FS portals and by ensuring that technical experts in African countries have full opportunity to participate in the development of OSS/FS.

5.3 Training and Human Resource Development

Some of the potential transfer of technology and information sharing could happen between the European and North American countries and Africa in the areas of teacher education. It is likely that once distance education programmes like those in Ethiopia and Ghana are implemented, the integration of Special Educational Needs information and awareness will be much easier. One such programme developed by the National Centre for Technology in Education based in Ireland is mentioned below. A series of courses has been designed for teachers working with children from mild to severe/profound learning disabilities. These courses are provided as In-Service or summer holiday course training. Teachers normally need to have completed a basic ICT course (20 hours) before they can register to do a Special Needs module.

National Centre for Technology in Education (NCTE), Ireland

Special Needs and ICT – The Basics (20 hours) The course provides exposure to a range of potential ICT uses with special needs students, practical sessions for development of some ICT skills, particularly in software use and the Internet and opportunities to build confidence in using ICT with special needs students

ICT and Special Needs - Mild General Learning Disabilities- (20 hours) This course explores ways in which ICT can be used to support individual students' needs, exposure to on-line resources/software which the teacher can use to remediate those needs, learn about the use of these resources and strategies to assist with their integration into the curriculum, learn about different uses of ICT, such as the use of ICT to motivate students and to create individualised teaching and learning materials.

ICT and Special Needs - Moderate, Severe/Profound General Learning Disabilities and Multiple Disabilities- (20 hours) A specialised course looking learn about different uses of ICT, such as the use of ICT to develop attending/responding skills and to create individualised teaching and learning materials, focus on a topic of particular interest to the participant through a project in a supported environment

http://www.ncte.ie/index.htm

Inclusive Consultancy, a branch of Inclusive Technology, in the UK, has developed a set of resources as part of the New Opportunities Fund (NOF) providing ICT Training for teachers and assistants working with Severe and Complex Special Educational Needs. There is a range of training units that cover how to search information on the Internet, basic ways of introducing ICT to the vision impaired, and ICT resources for pupils with multiple disabilities. The resources are freely available for use in not-for-profit situations, to help pupils with Special Educational Needs overcome the extra challenges they face. You can freely download, print out and make copies of any of this information for non-commercial purposes (see http://www.inclusive.net/resources/resources.shtml).

ITS – ICT a programme of the Ministry of Education in Sweden have carried out a programme (1999-2002) with the aim to increase the IT skills of teachers. Approximately 40% of all teachers benefited from the in-service training in education in ICT. Those who had even one student with a disability in their class received special guidance on ICT and the opportunities that the new technology opens for pupils with disabilities (http://www.itis.gov.se/english/index_in-service_training.html).

The provision of ICT courses and how they can influence the learning outcomes of individuals with SEN, should be integrated into teacher training courses in Special Educational Needs. It is essential that teachers understand the pedagogy and remediation behind the integration of ICT into the mainstream classroom or a special school. Four year Bachelor of Education courses for student teachers should have a module on exposing trainee mainstream teachers to Special Education and Inclusion. The University College of Education Winneba (UCEW) in Ghana, for example, is planning to provide ICT training to its students. However, there are currently no plans to provide specific training in ICT for teachers wishing to work with vision and hearing impaired students or those with intellectual disabilities. The lecturers are aware of the impact that ICT can make on teaching practice in schools and are investigating ways of introducing basic ICT skills to teachers followed by more specific courses in the student's chosen specialist area.

Teacher Training Colleges and Universities can play a key role in helping to build teachers' awareness of how ICT can be integrated into their teaching practices. The funding of training courses and the supply of adequate equipment both in terms of hardware and software are considerations that must be taken at educational planning level. We have already stated the high costs of Assistive Technology and how African countries need to reduce the high prices developed countries pay for equipment.

Teacher Training colleges that have computers should consider running courses in ICT and SEN, using CD ROMs. There is a whole range of materials available and guidelines available off the Internet that can be compiled and used by lecturers running

courses in Special Education Departments. The BBC runs an introductory course "Webwise – The Beginner's Guide to the Internet". This course takes the novice learner through the initial steps of how to use the Internet; Imfundo funded the development of an African version of this resource (See http://www.bbc.co.uk/webwise).

5.4 Infrastructure challenges

Developing countries are experiencing rapid modernisation of telecommunication systems. Most networks in Africa are analogue and many sections are highly unreliable, especially during the rainy season. The Internet depends on a good quality telecommunications structure. The poor quality of existing networks impedes the development of the telecommunications infrastructure.

The single-most important benefit associated with access to new ICTs is the increased supply of information. Reducing the cost of producing and transmitting information increases its availability and accessibility, which in turn reduces uncertainty. The process of building infrastructure for target populations in cities and rural areas is a major recommendation in OECD studies.

The key issue for both governments and donors is to ensure that ICT access reaches even the most marginalized groups, while at the same time ensuring that ICT projects meet the needs and demands of the target population. The dynamic growth of NGOs has been the dominant social trend of the past 30 years. Many NGOs have gained leverage and access to decision-makers through the effective use of new ICT to educate and organize citizens. Through ICT and AT these groups are bringing political power to the marginalized, raising awareness of economic, social and environmental issues, and directly influencing local communities.

There is a series of measures that can be made to increase the access to information. The strategic plans put into place for each country should build upon existing infrastructure. These include building on the role of telecentres, libraries and resource schools with adequate buildings and electricity supply to house the ICT.

Telecentres

Telecentres run by or with the involvement of developmental NGOs are more likely to target poor and marginalised communities and focus on much-needed additional services (training, content creation, provision of public goods) without which ICT access provision would be of limited developmental use. Telecentres in schools and universities have the advantage that their establishment is based on existing physical infrastructure which can be extended to accommodate the telecentre; some of the ICT-

relevant training can be cost-effectively integrated into the mainstream curriculum of the educational institution (George Caspary 2002). UNDP used the telecentre approach and has changed its strategy since telecentres are often not demand driven, difficult to sustain and lack content. "Multi functional community centres involving not only ICT access but health and wealth creation opportunities are now being piloted in some countries such as South Africa" (see www.iicd.org).

Meeting the needs of a growing population

In many countries, rapidly growing populations have resulted in expanded school enrolment and strained the capacity of existing facilities. Frequently, students are forced to rely on inadequate school buildings and libraries containing insufficient and outdated resources. The correct use of ICT can help alleviate shortages in teachers and physical materials and can be cost effective when compared to building new physical infrastructure.

Equalizing Access to Education

One characteristic of developing country educational systems is a pervasive resource discrepancy between urban and rural schools. This in turn leads to lower student performance and achievement, with many rural areas facing a chronic information deficit. ICT can alleviate these discrepancies, providing *all* students with access to modern pedagogical methods and knowledge. The introduction of ICT into the classroom and the sharing of information and pedagogical methods can lead to greater confidence in accommodating and teaching students with SEN.

Reaching the most disadvantaged communities, advertising access to computers may not be the most compelling draw to ICT. What could appeal more may be much more basic – a photocopier, fax machine, even a telephone. Over time, other functions will become popular such as computers and dedicated software for SEN. The gradual process of introducing technology is a surer way of increasing sustainability and building awareness and confidence to a new phenomenon.

Teacher training

Teaching requires a constant re-honing of skills and the ability to adapt to new tools and ideas. While it is difficult to measure the cost-effectiveness of continued teacher training, studies suggest that providing ICTs to schools greatly enhances a teacher's ability to fine-tune their pedagogic methods.

Assessment and Screening Centres

The role of Assessment Centres in the screening and diagnosing of young children for potential cognitive or sensory impairment can be further enhanced by using up-to-date assessment equipment and resources. These can vary from simple off-the-shelf

diagnostic assessment kits, which test a series of emergent developmental areas in literacy (e.g. visual sequential memory, hand-eye co-operation, fine motor skills and phonological processing) to more sophisticated kits that test communication and physical movement (e.g. Communication Assessment Kit or Switch Assessment Kit). See www.QEDLtd.com for examples of assessment kits.

Assessment kits are often built by Multi-Disciplinary Teams (MDT) (e.g. paediatrician, child psychologist, speech and language therapist, occupational therapist) who have specific skills that they wish to test on the child. Assessment kits can contain low-tech materials such as puzzles, soft balls, dolls, and children's cutlery. Instruction manuals and checklists are either provided by the Assessment Test Publisher and can be photocopied for professional use. Many of these materials are perishable and can become ineffective when damaged especially when assessing young children. Local supplies of wooden puzzles, toys and other test materials should replace old and out-of-date products in assessment centres. It is vital that all screening and assessment materials are kept in excellent condition and be used for these purposes solely. The creation of local tools (e.g. wooden puzzles and shapes) would also reduce dependence on imported tools which tend to cause problems for children because of significant differences in culture.

Equipping these centres with appropriate assessment materials should be decided at a Ministerial level so that there are standard materials, as well as standardised and diagnostic tests, in all centres. ICT can help assessment staff create and maintain good records of children who visit the centres. The introduction of a simple database system (e.g. Microsoft Access) where vital scores, dates and action plans can be entered will reduce the danger of children "slipping the net" when re-assessment, hospital referral or annual check-ups are required. Word-processing software programmes can be used to write programme plans for schools and teachers who receive assessed children and provide key information on what intervention programme needs to be implemented. The maintaining of records of the outcomes of any diagnostic assessment, of agreed learning programmes and of pupil progress will enable assessment centres to provide a better service to the child, his or her family and the school he or she will be attending.

The use of computerised tests has become a popular tool for assessing pre-literacy skills. Many of the tests are in the form of games with colourful graphics, animations and high-quality digitised speech. One such computerised set of tests is the CoPs (Cognitive Profiling System), built to determine dyslexia and other difficulties in literacy (http://www.dyslexiaa2z.com/testcops.html). The usefulness of tests such as CoPs indicates to the assessor a child's pattern of cognitive strengths and weaknesses. This should enable the assessor to build a profile and devise a remediation strategy for the class and resource teachers working with the individual. These tests can eventually be administered by trained teachers in schools, thus offloading some of the burden from the assessment centres.

Assessment centres can play a major role in the detection of cognitive and physical developmental delays in children in their early years. Close contacts between paediatricians, doctors and nurses at maternity clinics could help catch developmental delays at an early stage and prescribe appropriate intervention programmes. Similarly, essential good screening equipment is necessary and trained personnel to use them.

One centre in the UK that provides strong support for children at risk is the White Lodge Centre in Surrey. The Children's Centre here specialises in the assessment, therapeutic treatment and pre-school education of children with cerebral palsy and like conditions. The Assessment Centre also has an ICT Centre for the support of adults with cognitive and physical disabilities.

White Lodge Assessment Centre (UK)

The Children's Centre specialises in the assessment, therapeutic treatment and pre school education of children with cerebral palsy and like conditions. It has a supportive multi disciplinary professional team who work closely with children and their families, aiming to minimise the impact of the child's disabilities, maximise potential and develop independence.

The team draws upon a developmental theory base, and uses specialised treatment approaches, including Bobath and sensory integration, which are tailored to meet the child's individual needs. The nursery follows the Early Learning Goals according to the National Curriculum. Children's progress is regularly reviewed and contributions can be made to children's formal assessment and annual review.

Children under the age of two are seen on a sessional basis, accompanied by a parent or prime carer. Those over two may attend the nursery or continue to be seen sessionally.
The team supports inclusion into mainstream nurseries and some children may have split nursery placements. The team can also provide transitional support for nursery leavers who are going onto mainstream schools. Most children leave the nursery at five years of age.
http://www.whitelodgecentre.co.uk

White Lodge also has an IT Centre that is used for training adults with cognitive and physical disabilities in essential ICT skills. The centre specialises in a range of adaptive equipment and software to allow individuals with a wide range of abilities access a computer. Assessment Centres could envisage building an annex so that a computer suite is accommodated with appropriate AT. This would have to be run by experienced personnel who are able to assess the individual and match the device accordingly. These evaluations should be carried out in conjunction with medical and occupational staff and not solely without prior consultation.

5.5 Weighing the strengths and constraints of ICT for SEN in Africa.

Governments on the African Continent cannot afford to miss out on the digital highway. At the same time, as their education systems grapple with fundamental issues

concerning resourcing and capacity issues, ICT does not always make it to the top of the list. Research from around the world suggests that, particularly at the tertiary level and within the teacher education field, ICT and high-technological approaches can significantly enhance teaching and learning within resource poor environments. The policy makers within these contexts must ask several questions before embarking on programmes, which incorporate ICT. Eight key questions are listed below:

1. *Where are the greatest needs or challenges facing the Special Education Needs sector (human resourcing, curriculum, infrastructure etc)?*
2. *Where are the Government's key priorities for improving the sector?*
3. *What action has already taken place in enhancing the Special Education Needs sector?*
4. *What types of ICT could enhance these ongoing programs?*
   - *teacher education*
   - *inclusive education programming*
   - *special schools*
5. *If so what type of ICT would be most appropriate and most sustainable? (High, Medium or low technology?)*
6. *Where will the funds be located and most likely available to support this?*
7. *Do we have the infrastructure capacity to implement at this time?*
8. *Do we have the human resource capacity to teach ICT?*

ICT is a technology that is being introduced largely from the West and has a series of cultural biases that can affect the end users in Africa. These can include colour encoding, which is commonly used and understood in Western countries (e.g. red signifies a problem and green means go).

The lack of technical expertise in the field of ICT and its potential benefit in education cannot be underestimated. The introduction of any new ICT or AT should be complemented by sufficient training and technical support in order to reduce the stakes of abandonment. Support from NGOs through the hiring of IT specialists, volunteers and trainers in AT can help pave the way for the successful introduction and integration of ICT into special schools, rehabilitation workshops and the integration of students with learning disabilities into the mainstream classroom.

One of the greatest challenges confronting African governments is the need to reduce the extent of e-literacy (inability to use the Internet) and encourage teacher-training lecturers to build information skills, and research techniques into their training programmes. Teachers need to learn how to search the Internet and build knowledge-building skills so that they can resolve the problems they face when trying to integrate a child with a disability into their classroom or improving their own teaching practice.

The strengths outweigh the constraints of using ICT as long as those who hold the positions of responsibility take careful steps when considering their Education Strategic

Plans and seeing how ICT can be built into Special Education. Setting up any ICT program requires substantial financial backing by government departments. Clearly the initial costs of setting up the infrastructure for the smooth integration of ICT into schools are high. However, the benefit this investment brings to students with sensory impairments and/or other general learning disabilities can mean the difference between an individual being marginalized and excluded from education to an individual who can participate and become an active member in society enjoying equal rights to education.

5.6 Key recommendations

Heuman (2002) believes that in order for the Millennium Development Goals in education to become a reality in the area of disability, we need three things:

- Donors will need to increase their capability and capacity to be able to provide appropriate technical assistance to governments;
- Governments will have to be willing to include disabled children as a part of their targeted group;
- The NGO community of disabled individuals will need to become more knowledgeable about the issue of education and more involved in working with governments and other organisations that focus on education.

Progression from low to high technology

The electronic and communication infrastructure in Africa is not yet in place for medium to high tech based solutions within the SEN environment. However low tech solutions could be quickly introduced and sustained within special schools and inclusive learning environments within Africa. This can take place only if the private and civil society sectors take a lead role due to the ever-growing pressures on public financing within Africa.

Low tech solutions such as school books in Braille, large print readers, tactile books and other teaching learning materials can be produced in Africa. Already countries are setting up centres for material resource production. Ghana's Material Resource Centre for the Disabled is one example, which needs expansion and support. The formation of linkages with international suppliers of low tech and medium tech solutions should be encouraged. These linkages could enhance the access of children with disabilities into mainstream educational programmes. It can also reduce the burden on teachers and school management by enhancing the integration of children who would otherwise be marginalized.

High tech solutions are feasible, relevant and are necessary for the blind as well as within the tertiary education sector where students with disabilities have been restricted

from attaining their full potential as citizens. Libraries with ICT at tertiary and teacher training college level are most appropriately resourced with talking books and large print materials, CD ROMs, cassette tapes and access to the Internet.

Transfer from European and North American Contexts to Africa

Governments and private sector enterprises in Africa are increasingly advocating for reduced costs for purchasing assistive technology and high tech solutions. For instance in South Africa and Namibia software and adaptive technology is being supplied at a reduced rate which increases access to high tech solutions. For many countries open source software holds out the promise of high tech independence." [11]

African governments could usefully eliminate import taxes on educational and computerised technology particularly assistive technology. Sub-Saharan Africa still has a very low rate of computer to person ratios, which can "cripple" an already deprived continent of these basic tools for learning. More work is needed to build on existing solutions developed in Europe and North America in order to transfer skills and build homegrown solutions. One of the most promising examples is within the hearing impaired category - a full-scale educational programme for training educators of the deaf in Africa is needed. ICT can make a tremendous impact when given the chance and with the use of video and national television for teaching sign language.

Where are the opportunities for Assistive Technology?

The first steps involve exposure and awareness creation among educationalists and service providers within industry to kick-start a creative revolution for Special Educational Needs and mainstream schools within Africa. Most of the examples within Africa have been initiated by individuals interested in communication technology and have required voluntary/private support.

Opportunities for assistive technology integration appear most promising in assessment centres, teacher training institutions, and special schools. Distance education and in-service training programmes afford an important vehicle for the introduction of assistive learning technology. Existing courses are readily available from countries such as Ireland and the UK - and many of these are on the Internet, free of charge and can be easily adapted to courses for teachers in Africa.

Governments obligated to fulfil a percentage of the workforce with people with disabilities can only achieve this by increasing appropriate skills training using adequate assistive technology (i.e. JAWS or synthesised voice recognition programmes).

[11] Newsweek, July 7, 2003.

Governments should also consider creating minimum standards, particularly in the area of assistive technology to ensure that well tested products are used.

A first step within the African context appears to be ensuring that children with special educational needs are provided with an Individualised Education Programme (IEP). These IEPs should be adapted to the needs of learners particularly children who are being mainstreamed into the public education system. IEPs are an essential step to identifying learning needs that can be addressed by assistive technology. This will require training and orientation of teachers within the public school system and social service providers (i.e. assessment centre multi-disciplinary teams).

Role of the Private and Non Profit Sectors in Africa

There is a long-standing and growing need for more private business participation in the education sector particularly in SEN. Many of the solutions, which are high tech, can also appeal to business based solutions and enhance business capabilities (i.e. gadgets, smart boards, interactive white boards, digital voice recorders). Linking private sector companies between Africa, Europe and North America holds promise for future development in ICT and SEN. Governments are very supportive of developing their ICT sectors and would welcome the transfer of knowledge-based technology and the establishment of business linkages between the continents.

This study revealed that Africa has benefited from the special commitment and excellent services volunteers are rendering on the continent in the form of training and technical support (e.g. Peace Corps, Voluntary Service Overseas, Cross Roads, Net Corps). Large-scale introduction of ICT in Africa will only be achieved through a growing focus and commitment of voluntary organisations to promote and build capacity for successful and sustainable ICT integration particularly in the SEN sector.

Conclusions

A central theme running throughout this report is the “gap” between what is theoretically possible and what is achievable in everyday reality in the short term. We need to bridge the difference between those who have access to assistive technology and those children who struggle without. Bridging this gap cannot be met without careful analysis of what can be achieved in a reliable and sustainable way to assist as many individuals with disabilities as possible. Therefore the “fit” or “match” must be carefully judged taking into consideration the full range of potential technology solutions easily integrated into the learning and living processes of an individual with disabilities.

The non-African experiences captured earlier clearly demonstrate how new technologies can aid students with disabilities become achievers in the classroom within a special school or an inclusive setting. The introduction of any new device - low or high tech - in an educational setting requires a strong commitment by all those involved in the student's learning, communication and general well being. As we have argued, there is no easy fix or quick fit solution to the use of ICT or AT.

There is a clear message resulting from the studies and interviews carried out for this report that given the high costs and difficulties of introducing and maintaining ICT in schools and colleges in Africa, low technological solutions and practice appear a good stepping stone for the immediate future for reaching children in special schools. High technological solutions are more appropriate for introduction at the tertiary and teacher training level where SEN is being introduced in the mainstream. The introduction of computerised training courses already developed in the western world can enhance and attract teachers to issues concerning SEN.

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Annex 1 Sample Specifications for Desktop PCs Recommended for SEN Software

This list of specifications is designed to provide guidelines and recommendations for the acquisition of workstation computer hardware and software. Some individuals and disability groups may require more specialized configurations (e.g. Window Eyes for vision impaired). It is recommended that you consult an advisor in ICT before deciding upon the purchase of I T hard ware. ICT equipment and resources are expensive to maintain or replace. It is essential to set up a secure and reliable cataloguing system for all equipment and software.

Sample Specifications for a Desktop

- 700 MHz Processor
- 64 MB RAM expandable
- Minimum 10 GB Hard Drive
- 1.44MB 3.5” Diskette Drive
- CD-ROM drive
- Minimum 15” colour display screen
- Sound card
- Headphone jack and line-in Mic jack
- Stereo speakers
- QWERTY Keyboard
- USB ports for connecting mouse and other peripherals
- Software bundle to include Operating System (e.g. Windows 98, 2000 or Mackintosh 8.0 or later), an integrated office package (e.g. MS Office, Linux)

Extras: Black and White printer (Laser jet), headphones, scanner, 56.6 Kbs Modem, Additional backup device (ZIP drive, CD-RW, etc.)

Annex 2 Useful Internet Resources on ICT and SEN

Internet Resources

Note: The following is a sample of the extensive Assistive Technology online resources currently available. As the Net is a highly dynamic and evolving medium, new and improved sites are being posted so frequently that no list can ever claim to be fully comprehensive. We strongly suggest that you do your own web searches for sites of particular interest to you, as well as visiting the ones listed below.

Selected Websites for information on Assistive Technology	
Service Providers	
Links	**Organisation**
http://www.enableireland.ie	Enable Ireland
http://www.abilitynet.co.uk/	Ability Net Service Providers
http://www.ace-centre.org.uk	ACE Centre
General Suppliers of Special Educational Education Needs Software and Hardware	
Links	**Organisation**
http://www.inclusive.co.uk/	Inclusive Technology
http://www.donjohnston.com/uk	General AT
http://www.cricksoft.com/	Educational Software: Clicker:
http://www.widgit.com	Educational Software: Widgit
http://www.sensorysoftware.com	Switch Software
http://www.turningpointtechnology.com/	Keyguards
http://www.enablingdevices.com	Devices for Children
http://www.liberator.co.uk	AAC Products
Suppliers of Software for the Vision Impaired/Blind	
Links	**Organisation**
http://www.freedomsci.com	Text Readers, Screen Readers, etc.
http://www.dolphinfast.com/index.html	Suppliers of software
General Computer-Related Information on Special Educational Needs	
Links	**Comments**
http://www.schoolnet.ca/sne/e/index2.html	Resources on Special Education Needs
http://www.ed.sc.edu/caw/toolboxvendors.html	Tools for Educators
http://www.news-4-you.com/	Newspaper for Students with Special Needs
http://www.lucid-research.com	Computerised Dyslexia Assessment
http://enablelink.org/	International Links for People with Special Educational Needs
http://www.closingthegap.com	Education
http://www.abledata.com/text2/Default.htm	AT Database: Abledata
http://www.microsoft.com/enable/	Microsoft Accessibility Features
http://communities.msn.com/AdaptiveandAssistiveTechnology	AT On Line Community

http://www.ncte.ie/SoftwareCentral/Evaluations	Software Evaluations
http://www.thelearningstudio.com/	Learning Methods
http://natri.uky.edu	AT Research

AT Courses On Line for Special Educational Needs Teachers

Links	Organisation
http://www.at-training.com/	AT Training Online
http://www.wheelchairnet.org/WCN_WCU/wcu.html	Online Certificate in AT Applications and other AT Training Online

Web Access International Guidelines for Web Designers

Links	Organisation
http://www.temple.edu/inst_disabilities/piat/wave/	Temple University Web Access Tool
http://www.rit.edu/~easi/access.html	Equal Access to Software and Information
http://www.webable.com/	Accessible Design Help

Disability Issues

Links	Organisation
http://www.disabilityisnatural.com/peoplefirstlanguage.htm	Disability and Language
http://www.ldonline.org/ld_indepth/technology/zabalaSETT2.html	Education and Inclusion

Augmentative and Alternative Communication

Links	Comments
http://www.remc11.k12.mi.us/lcisd/augment.htm	Information on AAC
http://www.aacintervention.com/resources.htm	AAC Intervention Resources

Research Journals on Assistive Technology

Links	Name of Journal
http://jset.unlv.edu/	Journal of Special Educational Technology
http://www.atnet.org/news/	Assistive Technology Journal
http://www.iospress.nl/site/html/10554181.html	Free Technology and Disability Journal

Annex 3: Initiatives and Software for the Vision Impaired and Hearing Impaired

European Commission (2001) "eEurope 2002: Action Plan".

http://europa.eu.int/information_society/eeurope/action_plan/index_en.htm.

Bobby is a comprehensive web accessibility software tool designed to help expose and repair barriers to accessibility and encourage compliance with existing accessibility guidelines. Bobby tests for compliance with government standards, including the U.S. Government's Section 508. It offers prioritized suggestions based on the Web Content Accessibility Guidelines provided by the World Wide Web Consortium's (W3C) Web Access Initiative.

http://bobby.watchfire.com/bobby/html/en/index.jsp

CAST (Center for Applied Special Technology) – It supports the use of web accessibility guidelines of W3C. It is an educational, not-for-profit organization that uses technology to expand opportunities for all people, especially those with disabilities. CAST achieves its mission of expanding opportunities for individuals with disabilities through work in educational settings, research, and product development.

http://www.cast.org/

DAISY is the acronym for Digital Accessible Information SYstem

Members of the Consortium actively promote the DAISY standard for Digital Talking Books because it promises to revolutionize the reading experience for people who have reading disabilities. Consortium's vision is that all published information is available to people with print disabilities, at the same time and at no greater cost, in an accessible, feature-rich, navigable format. The DAISY Consortium has established a mission and goals in order to make this vision a reality.

http://www.daisy.org/

W3C (1999), "Web Content Accessibility Guidelines (WCAG)", World Wide Web Consortium (W3C).

These guidelines define a series of checkpoints, which, if satisfied by the web site, will ensure that it has a high possibility of being accessible to the widest possible variety of users.

http://www.w3.org/TR/WCAG10/

Useful information on Accessibility for the Blind

Royal National Institute for the Blind

http://www.rnib.org.uk/technology/

Products for People with Low Vision

Closed Circuit Television (CCTV) – A Closed Circuit Television consists of a camera, a magnifier and a screen. The camera produces a magnified image of what is on the page and this can be read by a vision-impaired person from the screen. The TV screen sits on a stand and is raised above the table. Underneath the camera is a flat surface on which the book can be placed and moved along two runners, which facilitate tracking of the lines.

MAGic® 8.0 Information Screen Magnification with Speech for people with low vision - The software magnifies the information the person chooses, from two times to 16 times its normal size. The smoothing feature eliminates jagged edges caused by bitmapping when images or characters are magnified on the screen.

ZoomText includes support for all Windows platforms, including Windows 95/98/XP Home/NT 4.0/Windows 2000 and Windows XP Professional, in one affordable package. The ZoomText Xtra family of software consists of two products levels: Level 1 is one of the most advanced screen magnifiers on the market! Level 2 offers a fully integrated magnifier with speech output - designed specifically for the low-vision computer user.

Products for people who are Blind

Overview of Technology for Visually Impaired and Blind Students

http://www.tsbvi.edu/technology/overview.htm

Duxbury Systems leads the world in software for Braille with Windows, Macintosh, DOS, and UNIX programs. The Duxbury Braille Translator (DBT) and MegaDots are used by virtually all of the world's leading Braille publishers. DBT supports grade 1 and grade 2 translations in English, Spanish, French, Portuguese, Arabic, Malaysian, Swedish, as well as other languages. This software can produce contracted and

uncontracted Braille, mathematics, and technical Braille.
http://www.duxburysystems.com/

Windows eyes a screen reading program, which allows access to Microsoft Windows and compatible applications through synthesised speech output. It is compatible with most popular Braille displays and voice synthesisers but keeps the standard look, feel and intuitive operations of the Windows Environment

http://www.freedomofspeech.com/wineyscreenr.html

HAL for Windows – Available for both Windows 95 and 98. It is easily installed and does not require a lot of training for first time users. Hal is compatible with a wide range of windows products and is fast reliable and responsive. Hal uses Dolphin's Orpheus multilingual speech synthesiser.

http://www.synapseadaptive.com/dolphin/Default.htm

JAWS (Job Access With Speech) provides speech output technology for your Windows 95/98/XP Home or Windows NT/2000/XP Professional operating system to provide access to today's most popular software applications and the Internet. JAWS uses an integrated voice synthesizer and your computer's sound card to speak information from what appears on the screen. JAWS can also display this information in Braille when used with refreshable Braille displays. JAWS provides access to a wide variety of information, education, and job related applications. The tutorial cassette tutorials offer step-by-step training using JAWS as your screen reader. Learn how to navigate and use applications including the Internet, and master the keystrokes that allow blind and low vision users to work in a Windows environment.

JAWS supports the following types of popular applications:

. Email-programs
. Word processors
. Spreadsheets
· Web browsers
· Project management and research tools
· Contact management software
· Presentation software
· Web development tools
· Software development tools
· Database management software
· Sound editing software...and much more.

Listening to the Internet, Listening to Windows 98 and Listening to Word are TECSO product kits that provide the user with a mental image of Windows 98 structure as well as its special keystrokes features. The kit also contains a companion tactile graphics and Braille, which gives the user a picture of the Windows environment. TECSO has also developed an interactive tutorial kit designed to assist blind and vision impaired users in learning how to use the Internet. Listening to Word teaches the vision-impaired persons to Microsoft Word 97/2000.

http://www.tecso.com.br/

Kurzweil 1000 is reading software that makes printed or electronic text accessible to people who are blind or have limited vision. Using Optical Character Recognition and Text to Speech technology combined with a unique audible user interface, Kurzweil 1000 converts the printed word into speech. Users can scan in books, articles, bills, and advertisements - almost anything that fits on a scanner, so they can quickly have the information read aloud. Moreover, the text can be saved in Kurzweil accessible format for future reference and modification.

Supernova for Windows provides speech output, screen magnification and Braille output all in one easy to use package. It is easily installed and is fast and responsive. It is compatible with a wide range of windows products, and comes with Dolphin's Orpheus multilingual speech synthesiser.

http://www.synapseadaptive.com/dolphin/Default.htm

Suppliers of software for vision impaired

Dolphin Peripherals

http://www.dolphinfast.com/index.html

FreedomScientific - develops and manufactures a full line of assistive technology hardware including JAWS for Windows, MAGic, Braille Displays and Braille Embossers.

http://www.freedomscientific.com/index.html

Techno-Vision Systems Limited

This company supplies an extensive range of software products, Braille Printers, Talking Dictionaries and Tactile Drawings for vision impaired.

http://www.techno-vision.co.uk/

Some useful links for hearing impaired/deaf

National Deaf Children's Society (NDCS)

http://www.ndcs.org.uk/index.html

NDCS campaigns for improvements in services aimed at families with deaf children, working with central and local government, health authorities, education professionals, social services, manufacturers and other voluntary organisations.

Royal National Institute for Deaf People

http://www.rnid.org.uk/index.htm

The website provides a wealth of information on Deaf awareness training, information on equipment and details on ICT being tested and equipped for the deaf.

British Sign Language

http://www.britishsignlanguage.com/

This animated website provides the user with details on how to sign the language and contains clips of film showing a person sign words and phrases. The full content is available on CD.

Deaf Children's Communication Aids Project (DCCAP)

http://www.dccap.org.uk/

The Communication Aids Project is funded by DfES and managed by Becta.

A speech recognition system based on a radio microphone and laptop computer can provide real time text transcription of teachers, parents and other pupils' speech.

The Deaf Internet Bookstore

http://www.deafbooks.com/

Peter Jackson is the acclaimed and only author worldwide to write and publish books in which deaf people are the instigators or victims of crime. These books are widely read around the world.

Modernising Hearing and Services

http://www.mhas.info/

The MHAS programme is funded by the Department of Health and aims to modernise hearing services within the NHS across England. MHAS is about improving patient services, as well as making the latest hearing aid technology available on the NHS.

Remark!

http://www.remark.uk.com

Remark acts as the catalyst between service providers and the Deaf Community. Services ranges from translating publications into British Sign Language to providing deaf awareness training. This company has produced a very successful video "Protect Yourself", a HIV awareness video produced by and for Deaf people in Ghana. It was produced in collaboration with Deaf students from Mampong School for the Deaf, VSO, the British Council, Ghana.

Annex 4: Suppliers of Special Education Needs Software

This list is only a selection of the most reputable suppliers of software in Europe and North America. This selection does not advocate a preference for any of them but rather a suggestion.

Crick Software http://www.cricksoft.com

This company produces the award winning Clicker, which combines a powerful talking word processor with grids, making it a very powerful literacy tool.

Don Johnston http://www.donjonston.com

Early literacy interventions, word study interventions, writing interventions, word prediction increases independent writing skills

Inclusive Technology http://www.inclusive.co.uk

Helps to identify software that has extra access elements for learners who find the mouse or keyboard difficult to use or understand. Most of the early learning section programs have switch access.

Inspiration http://www.inspiration.com

Mind mapping and brainstorming software programs for teachers and students. Uses the principles of visual learning to help young readers and writers as they learn to develop and organise ideas, creative thinking. Inspiration would be suitable for teachers and Kidspiration for senior primary level.

Kurzweil Educational Systems http://www.kurtzweiledu.com

Kurzweil 3000 provides the tools and features for struggling students who need to improve their reading speed and comprehension and to become independent, confident learners.

Laureate http://www.LaureateLearning.com

Laureate produces software for students diagnosed with a series of speech and language impairments: autism, and other neurological conditions.

Sherston http://www.sherston.com

This company has developed a range of literacy and numeracy based software packages to develop letter recognition, rhyme and analogy, phonological awareness and early number skills

Semerc (Granada Learning) http://www.semerc.com

Semerc provides a wealth of software packages for a number of mild-moderate learning disabilities – literacy, numeracy, specific learning difficulties (dyslexia), life skills and emotional and behaviour disorders.

Sight and Sound http://www.sightandsound.co.uk

Supplies screen reader and multi-sensory (auditory and visual representation) including Kurzweil software for vision impaired and specific learning difficulties (dyslexia)

TextHELP! http://www.texthelp.com

These packages are useful for spelling, word prediction and auditory feedback. E.g. Wordsmith and Read and Write.

Widget Software Ltd. http://www.widget.com

Communication charts, picture labels, literacy aids, posters and schedules, overlays for communication devices. It produces Picture Communication Symbols developed by Mayer-Johnston and the black and white symbols entitled Rebus Symbol Collection.

Smart Kids Software http://www.smartkidssoftware.com

A portal of software companies that specialise in software for children.

Lists of software with up-to-date prices in USD.

Super Kids Software http://www.superkids.com/

Software to help with vocabulary and skill development for young children

Annex 5:

Some useful reference websites and software for children with Autistic Spectrum Disorders (ASD)

There are many advantages, not least the natural affinity with computers that many children with ASD often exhibit. Predictability, user control, and the fact that their use does not require spoken language are also positive features. The predictability and consistency of computers can encourage a child with ASD to develop his/her social, living and academic skills, thus reducing the chance of personal anxiety and inflexibility in the outside world. Here are listed some useful Internet sites for parents and teachers and useful computer software for students to use in the classroom.

Internet websites

Resources for teachers and parents working with children with autism, Asperger's Syndrome and other learning disabilities:

Autism Society of America – contains free newsletter and up-to-date information on the latest intervention programs for treating children with ASD.

http://www.autism-society.org/site/PageServer

Center for the Study of Autism - The Center provides information about autism to parents and professionals, and conducts research on the efficacy of various therapeutic interventions.

http://www.autism.org/

Dotolearn – contains helpful information on how to teach life skills (e.g. brushing teeth, going to the toilet, etc.) to children with autism and learning difficulties

www.ddoto.learn.org

Autism-PDD Resources Network – USA site of research into autism, guidance for special education and IEPs

http://www.autism-pdd.net

National Autistic Society – UK website for ASD and Asperger's Syndrome

http://www.nas.org.uk/index.html

Hugsfeelgood – A fun site for free printable greeting cards and free books for children with autism about autism.

http://www.hugsfeelgood.com/

Language Development in Children with Autism

This website is designed to provide information on language development of children with autism to parents, teachers, and students.

http://gladstone.uoregon.edu/~eneuhaus/psychology/psy.html

The Picture Exchange Communication System (PECS) was developed over 12 years ago as a unique augmentative, alternative training package that allows children and adults with autism and other communication difficulties to initiate communication. First used in the United States, PECS has received worldwide recognition for focusing on the initiation component of communication.

http://www.pecs.org.uk/welcome.asp

Computer Software for ASD

Boardmaker – Computer-based picture symbol resources

http://www.inclusive.co.uk

Laureate Learning – USA Software Company for specialised software for speech and language conditions. Designed by pathologists.

http://www.laureatelearning.com

SEMERC –(Granada Learning) – A variety of software literacy, numeracy and social skill building.

http://www.granada-learning.com/semercindex/

Sherston – A whole range of software available for children who enjoy "Talking Books" – highly visual and multi-sensory, e.g. Oxford Reading Tree.

http://www.sherston.com

Smart Alex – Learn how to recognise facial expressions and emotions from an animated character.

http://www.inclusivetlc.com/catalog/learning/smartalex.shtml

Hardware Devices

Input switches – Children and adults with physical and communication difficulties can use input switches allowing them access a whole range of equipment that otherwise would be out of reach. These include lever switches, jelly bean switches, and chin switches and soft cushion switches. A switch is an input device for students with physical disabilities to access computers, environmental controls or communication devices. They are pressure sensitive and a simple press causes activation. It is possible to run single-switches to emulate mouse clicks, run single-switch software and use the scanning method for running the computer.

Communication Aids –These are usually portable communication devices that use synthesised speech including VoicePal, DigiMax, Lightwriter, Liberator.

Interface Devices – **These include Rollers, Joysticks and different keyboards (e.g. Big Keys)**

Hardware suppliers

http://www.QEDLtd.com

http://www.inclusive.co.uk Supplies Penny and Gilles Rollers and Joysticks.

http://wwwdonjohnston.com

Annex 6 Starting a Resource Room to Support Learning

The allocation of a resource space or room is a useful start to building awareness to staff.

HealthLink Worldwide Resource Centre Manual

A resource centre can be any size, from a trunk of books or a few shelves, to a whole room or several rooms. A resource centre may be part of an organisation or an organisation in its own right. It may serve staff within the same organisation, people from other organisations, members of the public, or a mixture. It may be staffed by a volunteer or someone for whom it is only part of their job, or by a team of professional librarians and information scientists who are responsible for different aspects of managing the collection and providing information services. A collection of materials in a hospital or health centre meeting room, a few shelves in a room at a training institution, or a room in a community centre – all these are resource centres.

http://www.healthlink.org.uk/rcman/rchome.html

The Adult Learning and Documentation and Information Network provide a list of useful hyperlinks to pdf papers and websites on

How to set-up and run a Documentation / Resource Centre.

How to develop Internet and other Information Technology Skills.

http://www.unesco.org/education/aladin/resource.html

Some recommended equipment and materials for your Resource Room.

- Tape recorders with in-built microphone (e.g. Grundig)
- A supply of C90 cassettes to record lessons for vision impaired students
- A laminator – to cover printed sheets and signs
- Laminating sheets – A3 and A4 sizes
- Velcro strips – hook and loop
- Coloured markers (Felt pens) to mark equipment with name of school
- Software – Widgit Boardmaker – REBUS (Black and White symbols for schedules, labelling boxes and signs for classroom)
- Binding machine Binders are available in a variety of formats including plastic comb binding, wire ring binding, plastic coil, thermal, and perfect binding.

Paper cutting and trimming machines to cut posters, trim paper and make neat edges to signs.