Research & Studies

Information and Communication Technologies (ICTs) and Inclusive Education

West Africa Desk
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The document is accompanied by the **ICT Directory for Inclusive Education**, which presents all the ICTs identified during the study. The directory is available at the following address: ICT Directory for Inclusive Education | Source (asksource.info)

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Summary: Main findings of the study

1. Background and objectives of the study

- **Children with disabilities** are among the **most excluded** learners in the **education system**. The **exponential development of ICTs** (Information and Communication Technologies) throughout the world is a real opportunity to improve the educational inclusion of these children.
- The aim of the study was to: **i) identify existing ICTs** that can support the educational inclusion of children with disabilities; **ii) identify the challenges to the implementation of these ICTs** in the classroom in some of Handicap International's French-speaking countries of intervention, namely **Benin, Burkina Faso, Madagascar, Mali, Morocco, Niger, Senegal and Togo**. The study consists of two separate documents: this report outlining the methodology of the study, the process for the development of the ICT Directory, and the main lessons learned, on the one hand, and a document listing the ICTs identified during the research, on the other hand.
- The study was based on **secondary research, interviews with experts and with potential users of the ICTs in the intervention countries**, namely teachers, parents and students with disabilities in Benin, Niger and Senegal.

2. Main findings

- **While ICT has an important potential to promote the inclusion of children with disabilities in education**, **it cannot remove all barriers** (non-adapted facilities, discrimination against children with disabilities, etc.). The use of ICT in inclusive education programmes therefore complements other actions aimed at removing these barriers.
- **ICT can help to make schools more inclusive** and enable them to play their role to the full, which is to impart knowledge, skills and attitudes to all students without distinction. To achieve this, **the school must make the content and activities it offers accessible to all students**, i.e. enable everyone to communicate with the teacher, communicate with other students, access written material, access oral material, express themselves in writing, express themselves orally, take notes to memorise their lessons, and access various teaching tools/information.
- Educational content and activities in schools can be divided into three main categories:
    - **i)** **Mainstream educational content and activities**, which have not been designed taking into account specific difficulties that some children may have;
    - **ii)** **Accessible educational content and activities**, which have been designed for all and are therefore accessible to all children with and without disabilities;
    - **iii)** **Specialised educational content and activities**, which are specifically aimed at children with disabilities who encounter a certain type of difficulty.
- **ICT provides teachers with all kinds of educational content and activities and makes them accessible to all their students.** ICTs can be classified into three main categories:

i) **The educational content and activities in themselves**, i.e. digital media used to deliver lessons and impart knowledge/skills to the learner (an audiobook, an educational video with sign language interpretation, etc.);

ii) **Hardware** that is used to make certain educational content/activities accessible (e.g. a computer for viewing the sign language interpretation of an audio document);

iii) **Accessibility features** that make hardware accessible to all (e.g. a screen reader that allows a blind or visually impaired student to use a computer to access content on the internet).

- **Despite their potential to foster inclusive learning, the use of ICT in schools in the intervention countries faces a number of barriers** such as unsuitable school facilities (lack of access to electricity and internet, lack of secure space to store the ICT in the school, etc.), lack of quality equipment (computers and software that are not suitable and are not updated, lack of furniture adapted to the use of computer equipment in classrooms, etc.), limited computer skills of teachers and students, lack of medical support (occupational therapists) to maximise the impact of the ICT on children's inclusion in school, lack of clear consensus on the use of ICT in schools, lack of clear guidelines for the lending and maintenance of ICTs in schools, lack of will, resources and a clear vision for ICT and inclusive education at government level, etc.
- **Despite these challenges, ICT has a real potential to support the educational inclusion of children with disabilities.** Some of the recommendations for improving ICT adoption in inclusive schools include providing the schools with electricity (off-grid solar energy can be considered), providing an internet connection (mobile internet, for example), providing relevant and quality computer hardware and software (giving priority to the acquisition of equipment adapted to the project rather than relying on donations), computer training for teachers and children, support of medical professionals for the implementation of ICT in schools (video exchanges between teachers and experts, for instance), organisation of general meetings to define best practices for the use of ICT in inclusive schools, signing of clear documents defining the roles and responsibilities of all the players involved in an ICT project, particularly with regard to equipment maintenance, integrating the use of ICT for inclusive education into national education strategies, and advocacy with major tech players to encourage them to commit to the use of ICT for inclusive education.

Background and objectives

1. Background

Children with disabilities are among **the most vulnerable and excluded young learners** in the world[1], with education systems and services failing to meet their needs in terms of access and quality.

Humanity & Inclusion – Handicap International (HI) has been working for the **inclusion of children with disabilities in education** for many years. Guided by the ***International Convention on the Rights of Persons with Disabilities***, which states that children with disabilities 'should not be excluded from the general education system', HI supports **an education system that is inclusive, where all children learn together**.

Information and communication technology (ICT), although still largely underused, has **considerable potential to support the educational inclusion of children with disabilities** by enabling them to overcome many barriers that cause their exclusion. A study conducted by Altai Consulting and the GSMA in 2019[2] found that **36% of visually impaired Kenyans considered that their mobile phone helped them 'a lot' in accessing education**, a figure that rose to **71% for those who owned a smartphone**, as the device allowed them to access many essential assistive technologies for studying, such as screen readers.

In **West Africa**, **poverty**, **social stigma** and **lack of political will accentuate the marginalisation of children with disabilities**. This context creates new barriers, such as lack of teacher training and negative teacher attitudes. For a child with a disability living in one of the study countries (Benin, Burkina Faso, Madagascar, Mali, Morocco, Niger, Senegal and Togo), going to school is an ordeal that often discourages children and parents.

Yet, **the development of ICTs in these countries is exponential and represents a real opportunity**: almost **two thirds of Malians or Senegalese own a mobile phone**, and **smartphones** (which offer essential assistive technologies) and mobile internet (internet is a prerequisite for the use of many ICTs) are constantly expanding.

HI has been working for many years on the inclusion of children with disabilities in schools in various French-speaking African countries (Benin, Burkina Faso, Madagascar, Mali, Morocco, Niger, Senegal, and Togo). Its activities have focused on **identifying children to be enrolled in school**, raising parents' awareness of the importance of sending their children with disabilities to school, and **training teachers and educators in inclusive education**. **The use of ICTs in HI programmes in French-speaking Africa has remained relatively limited until now**, but there are a few good examples such as Niger where 67 partner schools received adapted teaching materials in 2018 (tablets, punches, Braille paper, computers with voice recognition software, etc.).

In order to better evaluate the **potential of ICTs for inclusive education** and to prepare their integration in possible future programmes in French-speaking Africa, HI decided to **create a directory in French that lists existing ICTs with the potential to improve the schooling of children with disabilities**. Although databases listing digital assistive technologies exist, most are **available in English**

[1] Education for All, Global Monitoring Report 2020.

[2] Understanding the mobile disability gap: Insights on mobile phone access and usage by persons with disabilities in Kenya and Bangladesh, Altai Consulting & GSMA, December 2019 (link: https://www.gsma.com/mobilefordevelopment/resources/understanding-the-mobile-disability-gap/)

only, are **not specific to access to education** for children with disabilities, and **do not always list all existing technologies** (mainstream ICTs, assistive features, specialised equipment, etc.).

HI wanted to develop a **practical and easy-to-use working tool** for its staff and all its partners (ministries, partner NGOs, DPOs, etc.) and **initiate reflection on the opportunity to include ICTs in future inclusive education programmes** in its countries of intervention in Francophone Africa.

2. Objectives

The objective of the study is to **carry out an inventory and analysis of Information and Communication Technologies (ICTs) likely to promote the educational inclusion of children with disabilities** in HI's countries of intervention in French-speaking Africa (Benin, Burkina Faso, Madagascar, Mali, Morocco, Niger, Senegal and Togo). More specifically, the study aims to:

- **Identify existing ICTs that can support the educational inclusion of children with disabilities** This includes mainstream ICTs (computers, mobile phones, etc.) and accessibility features that enable children with disabilities to use them, but also assistive technologies, resources in accessible formats, courseware, and Virtual Learning Environments (VLEs). The directory presents the technical characteristics and requirements for each ICT (available languages, cost, licences, etc.).
- **Identify challenges to the use of ICTs in the classroom in the countries of intervention** and propose measures (including recommendations to governments) to ensure their proper use and ultimately improve access to education for children with disabilities through ICTs.

Methodology

To carry out this study, **mixed methods** were used:

- **Secondary research:** a wide range of literature was reviewed to identify ICTs with the potential to support inclusive education and overcome barriers to their use. These documents included HI's public and internal reports on programmes using ICTs, government reports or legislation on the rights of people with disabilities, documents on the development and use of ICTs in the target countries of the study (ITU, GSMA, etc.), documents on assistive technologies, accessibility features and inclusive education, reports from international organisations (UNICEF, African Union, etc.), specialised databases (GARI, Le Comptoir des Solutions, Eastin database), etc.
- **Interviews with international experts:** 12 interviews were conducted with international ICT and disability experts or education and disability experts. These experts included representatives of international organisations and NGOs, tech players, representatives of the global mobile industry, etc.
- **Interviews with experts in the countries of the study:** 12 interviews were conducted with experts from the countries of the study. These experts included representatives of the Ministry of Education, representatives of Disabled People's Organisations (DPOs), entrepreneurs who have developed assistive technologies, school directors, etc.

- **Interviews with potential ICT users in the target countries:** 14 interviews were conducted in Benin, Niger and Senegal with potential users of ICTs as educational tools. The interviews were conducted with students with visual, hearing, motor or DYS disorders[3], but also with parents of students with disabilities and teachers.
- **Interviews with HI ICT resource persons:** two interviews were conducted with HI ICT resource persons: Julia McGeown, Inclusive Education Specialist, and Virgile Ahohuendo, Regional Accessibility Specialist – Sahel Atlantic Programme (SAHA).

As part of her internship at HI at the time of the research, **Julia Mills** contributed to the study. Julia participated in the identification of the ICTs and conducted interviews with project managers, which were used in three of the case studies presented in this report. Julia also tested the quality and usability of some of the ICTs for deaf people presented in the directory (e.g. checking the accuracy of the ASL interpretation offered by artificial intelligence).

This report is accompanied by an ICT Directory for Inclusive Education. which presents **all the ICTs** identified during the study.

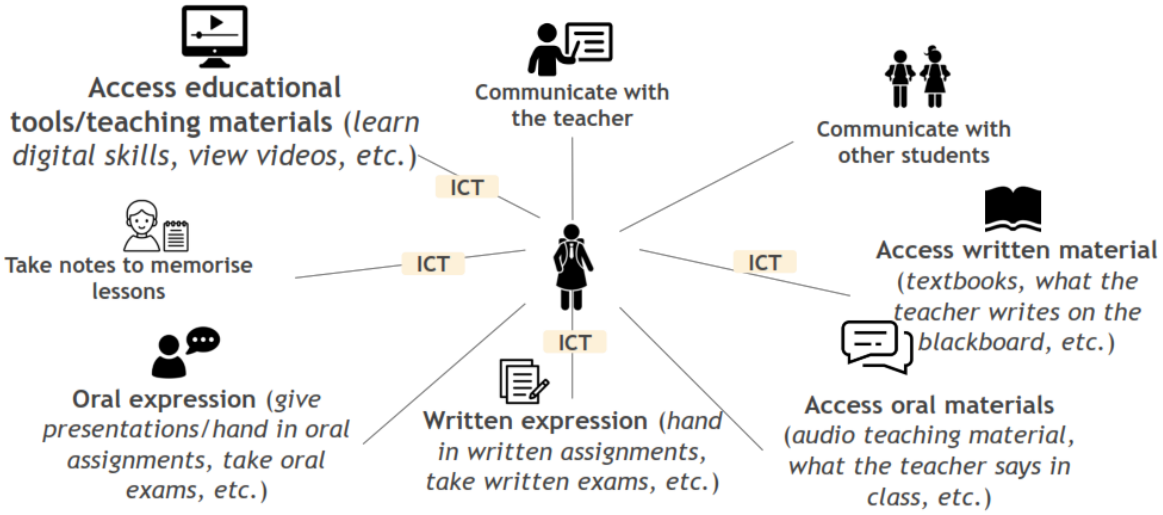
The detailed methodology of the study, including the names of the experts interviewed and the full bibliography, is presented in the annexe to this document.

[3] DYS disorders or specific cognitive disorders include dyslexia, dysorthographia, dyspraxia, dyscalculia or dysphasia. Attention disorders and memory impairment are also usually associated with DYS disorders.

Framework for the use of ICT in inclusive education

While there is no doubt that ICTs have great potential, they do not remove all the barriers to access to education for people with disabilities. **They must therefore be used together with other actions** and as part of a **comprehensive vision of the promotion of education** for children with disabilities. For example, ICTs will have no impact on the adaptation of facilities (buildings, toilets, etc.) or on the discrimination suffered by children with disabilities (even if we can imagine that, in the long term, communities will become more tolerant and benevolent towards children with disabilities thanks to awareness raising through digital channels). Thus, before presenting the **ICT directory for inclusive education**, ICT should be to **put in context**: alone, it cannot be a solution and cannot replace other methods and tools, such as learning Braille or sign language, and training teachers in inclusive education. **Nevertheless, ICT is a solution among others for making education accessible to all and deserves attention for its potential**.

In order to understand the potential role of ICT, let us briefly **recall the role of school education, which is to transmit knowledge, skills and attitudes to all children**. To fulfil this role, the school must **make all the educational content and activities it uses accessible to all, without exception**. This implies enabling each student to communicate with their teacher and classmates, access the written and oral material used in lessons, express themselves in writing and orally, take notes in order to memorise the lessons, and access all teaching tools and content.



A fully inclusive school should make all the educational content and activities used accessible to all students, regardless of their difficulties. The table below gives a few examples of adaptations that inclusive schools can make.

Examples of adaptations that can be implemented by inclusive schools

Communicate with the teacher • Teacher trained in sign language • Use of Augmentative and Alternative Communication (AAC) in the classroom • Teacher trained to teach students with intellectual disabilities	**Communicate with other students** • Sign language training for hearing students • Use of Augmentative and Alternative Communication (AAC)	**Access written material** • Provision of textbooks in large print and in Braille • Strategic positioning of students in the classroom according to their needs (next to the board, to the window, etc.)	**Access oral material** • Written transcript of the oral material used • Availability of a sign language interpreter for deaf and hard of hearing students
Express oneself in writing • Teacher who reads Braille • Physical adaptation of desks, pens, etc. for children with physical disabilities • Availability of a writing assistant	**Communicate orally** • Teacher trained in sign language • Availability of a sign language interpreter • Time adjustment (extra time, etc.)	**Take notes to memorise lessons** • Availability of an assistant to help with note-taking • Use of Perkins Braille machines	**Access the educational tools/content proposed** • Text and sign language subtitling of videos • Use of accessible equipment for computer classes • Braille graphics for economics classes

Unfortunately, **full educational inclusion is often a remote ideal**, especially in middle- and low-income countries. **The consequences of this lack of inclusion** are dramatic and prevent children with disabilities from having access to the full range of educational content and activities in school, **with strong repercussions on their access to quality education**.

The **ICT Directory for Inclusive Education presents existing technologies that can give children with different types of difficulties access to the educational content and activities** used by teachers.

How to use the Directory

This section presents the main definitions and classifications used to produce the ICT Directory for Inclusive Education and shows how to use it effectively.

1. Classification by type of difficulty

The ICT Directory for Inclusive Education presents ICTs according to the type of difficulty they help to overcome. **The directory uses the Washington Group[4] classification on functioning to categorise ICTs.** This classification is **the new international standard** for the collection of statistical data on people with disabilities. It is being adopted by more and more national statistical institutes, but also by international organisations, NGOs, etc. The ICT Directory for Inclusive Education is in line with this standard and could eventually help to better assess the ICT needs of a country (for example, if the study were to recommend the use of a given ICT for children with a specific difficulty, national statistics would help to make a quantitative needs assessment, i.e. the number of children with this specific difficulty).

Several Washington Group questionnaires have been developed, and new ones are being prepared. They allow for precision in the diagnosis (Washington Group Short Set on Functioning, Short Set on Functioning Enhanced, Extended Set on Functioning, etc.) and take into account the age of the person diagnosed (Child Functioning Module). **The directory, which focuses on the potential of ICT use in the classroom, uses an adapted classification of difficulties based on the Child Functioning Module** and, for reasons of simplification and readability, only retains the main difficulties that hinder learning in a classroom.

The five main types of difficulties selected for the directory are as follows:

- Visual impairment
- Hearing impairment
- Communication difficulties
- Difficulty remembering/concentrating/learning
- Difficulty moving upper limbs

2. Types of educational content and activities that can be accessed through ICT

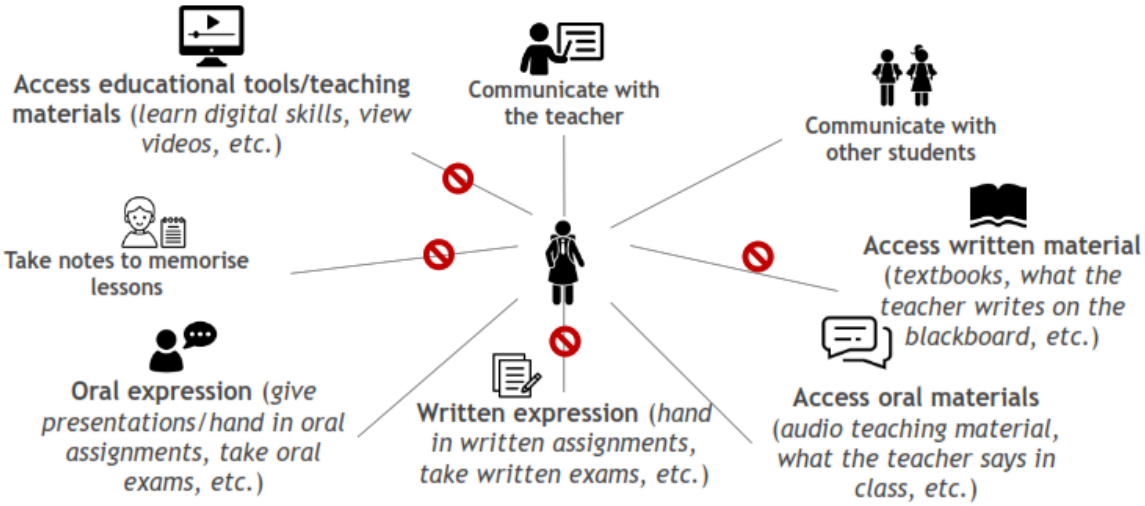
At the beginning of each section devoted to one of the difficulties mentioned above, there is a **diagram mapping educational content and activities** that children are deprived of when the school is not sufficiently adapted to their needs (access to written material, expressing oneself orally, taking notes, etc.). Some of the diagrams are shown below; the others can be found in the directory.

[4] https://www.washingtongroup-disability.com/

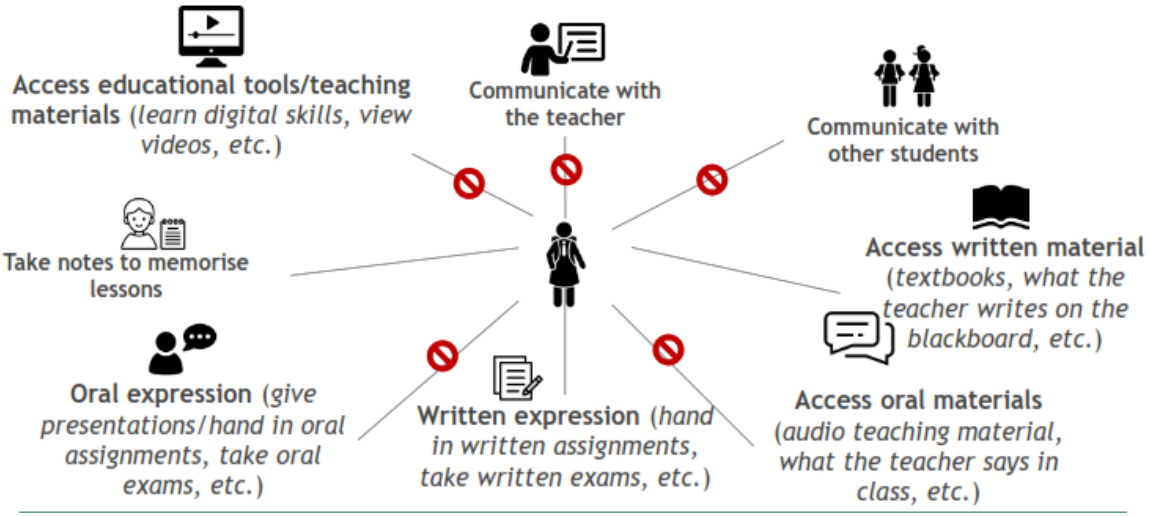
See

In a non-inclusive school, children with disabilities are denied access to certain educational content and activities

Consequences of lack of inclusion for a child with visual impairment



Consequences of lack of inclusion for a child with hearing impairment

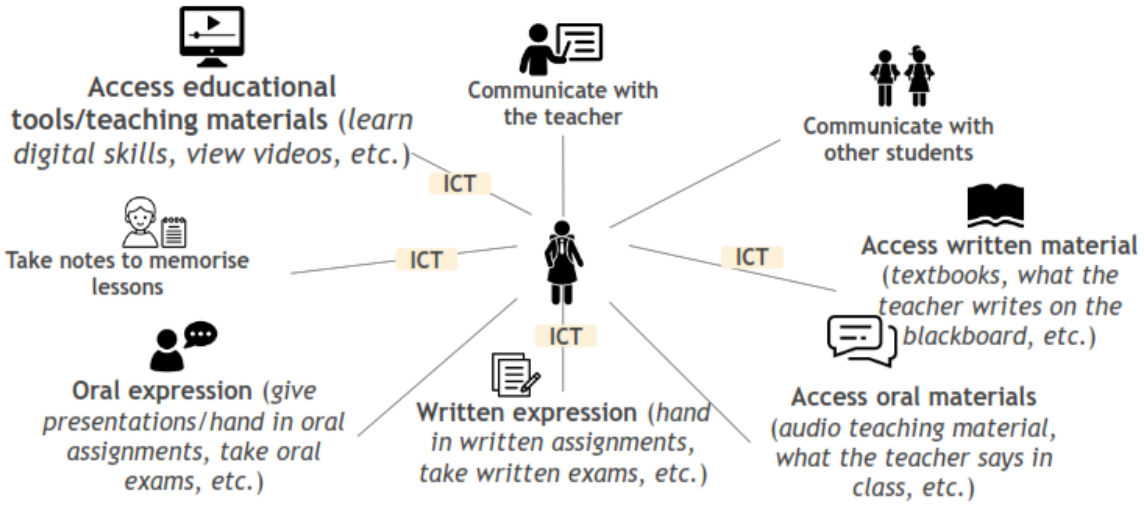


They help to **assess the potential and possible use of ICT for each difficulty**.

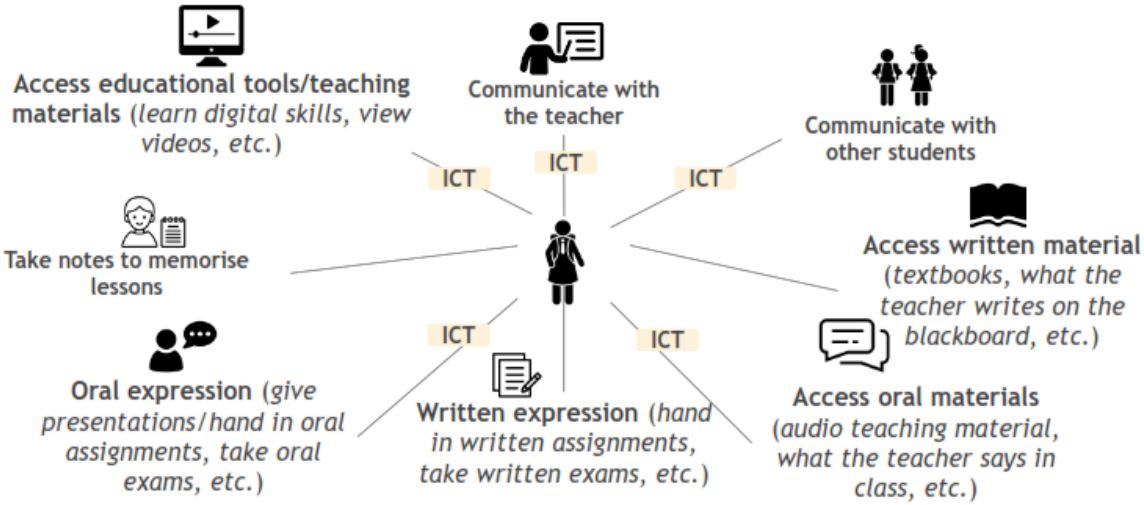
See

ICTs can help schools be more inclusive by providing alternatives to the usual non-inclusive educational content and activities

Potential of ICTs for the educational inclusion of children with visual impairment



Potential of ICTs for the educational inclusion of children with hearing impairment



The classification is also **included in the directory**; **for each of the ICTs presented, it indicates the type of content or learning activities** (access to written material, speaking, taking notes, etc.) t**hat it makes accessible**.

3. Classification by ICT type

Schools use different educational content and activities to fulfil their mission of imparting knowledge, skills and attitudes. There are **three types** of educational content and activities:

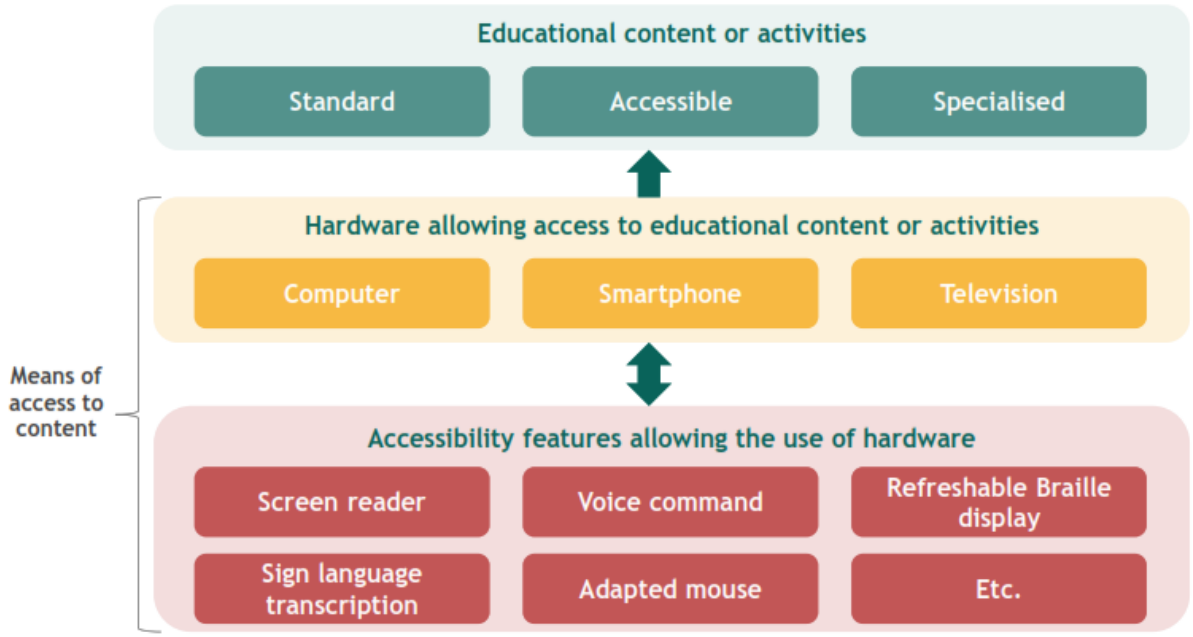
- **Mainstream educational content and activities:** this refers to educational content and activities that have not been designed taking into account specific difficulties that some children may have.
- **Accessible educational content and activities:** this refers to educational content and activities that are intended for and accessible to all children, whether or not they have a disability.
- **Specialised educational content and activities:** this refers to educational content and activities specifically designed for children with disabilities who have a certain type of difficulty.

Sometimes, the child can access these educational content and activities directly but, in some cases, they may need **specific equipment (hardware**). For example, a computer is needed to access educational software.

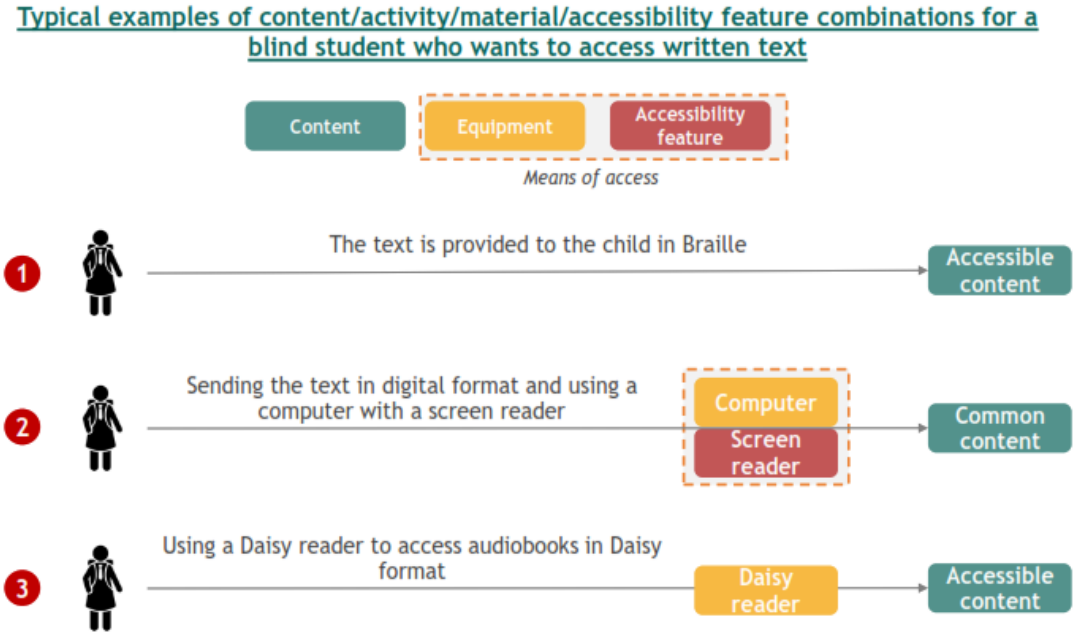
This **specific hardware is sometimes directly accessible** for the child, but in some cases the **use of accessibility features is required**. Some students with visual difficulties, for example, have to use specialised software to operate a computer.

The ICTs that are listed in the directory can be classified into two main categories:

- **Learning content and activities:** these are learning resources (games, learning exercises, lessons, virtual learning environments, etc.) the purpose of which is to help the learner acquire skills or retain knowledge corresponding to the learning objectives of the content or activity.
- **Means of access to educational content and activities:** this refers to ICT when it is used as a tool for accessing content or an activity; it is not the end goal for the student, but merely a means. There are two types of means of access: **hardware** that allows access to the content or activity, and **accessibility features** that allow access to hardware. Means of access can also be classified as follows: **mainstream means of access** (the design does not take into account specific difficulties that some children could have – e.g. a standard computer), **accessible means of access** (usable by all thanks to built-in accessibility features – e.g. an iPhone) and **specialised means of access** (designed specifically for children with disabilities who have a certain type of difficulty – e.g. a Braille writing device).



Depending on the student's difficulties and the type of content or activity, the school **may need to provide the student with means of access** to make the content and activities inclusive. **The types of content or learning activities, hardware and accessibility features can be combined in different ways.** For example, let's take the case of a blind student who wants to access a written document:

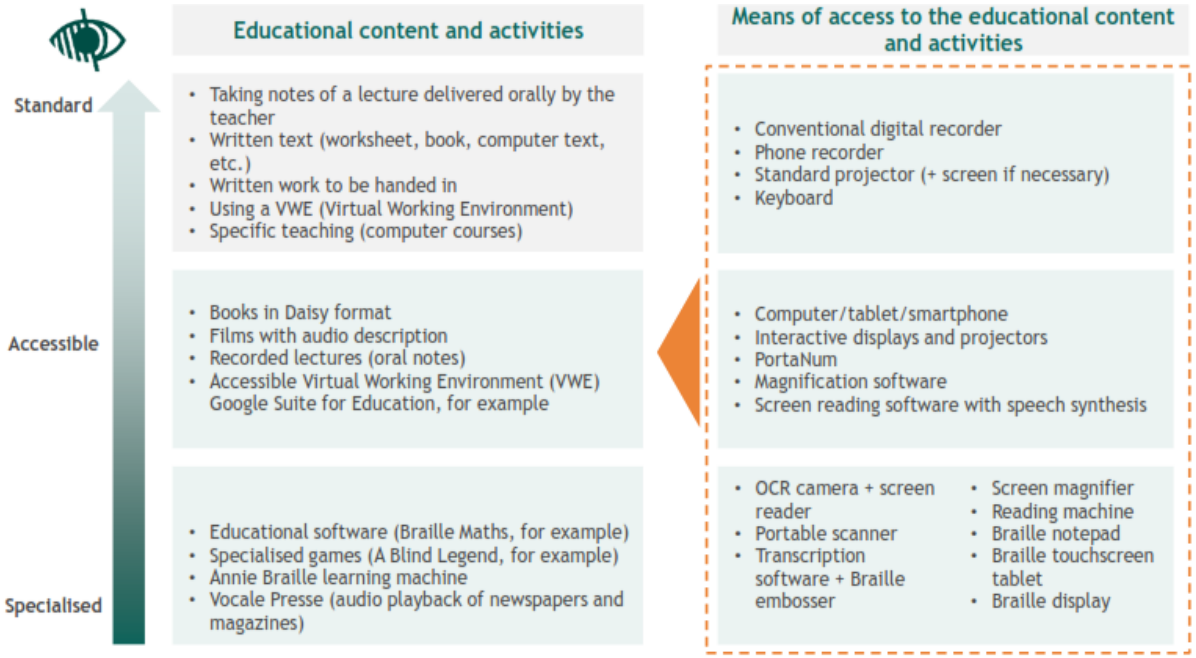


In general, and by definition:

- **Mainstream educational content and activities require, at least for some children, the provision of special means of access.** Some may involve the use of a newspaper article on the internet or a video that can only be played on a computer, tablet or smartphone.
- **On the other hand, accessible or specialised content and activities usually do not require any particular adaptation** to be used by all or by those for whom they are intended. However, as with mainstream educational content and activities, some may require the use of equipment, such as a computer, tablet or smartphone used to view a video with sign language interpretation.
- **Standard equipment** (computer, smartphone, etc.) **will require the use of accessibility features, at least for some children**. However, in recent years, new technologies have taken into account the need for inclusiveness; through **inclusive design**, accessibility features have been made available on standard equipment, making it usable by all (e.g. the Chromebook computer and the iPhone that have several accessibility features, including a built-in screen reader and voice control).

Each of the sections of the directory devoted to a type of difficulty presents **the ICT matrix based on the classification mentioned above**. Each ICT is mapped in this matrix, which uses two criteria:

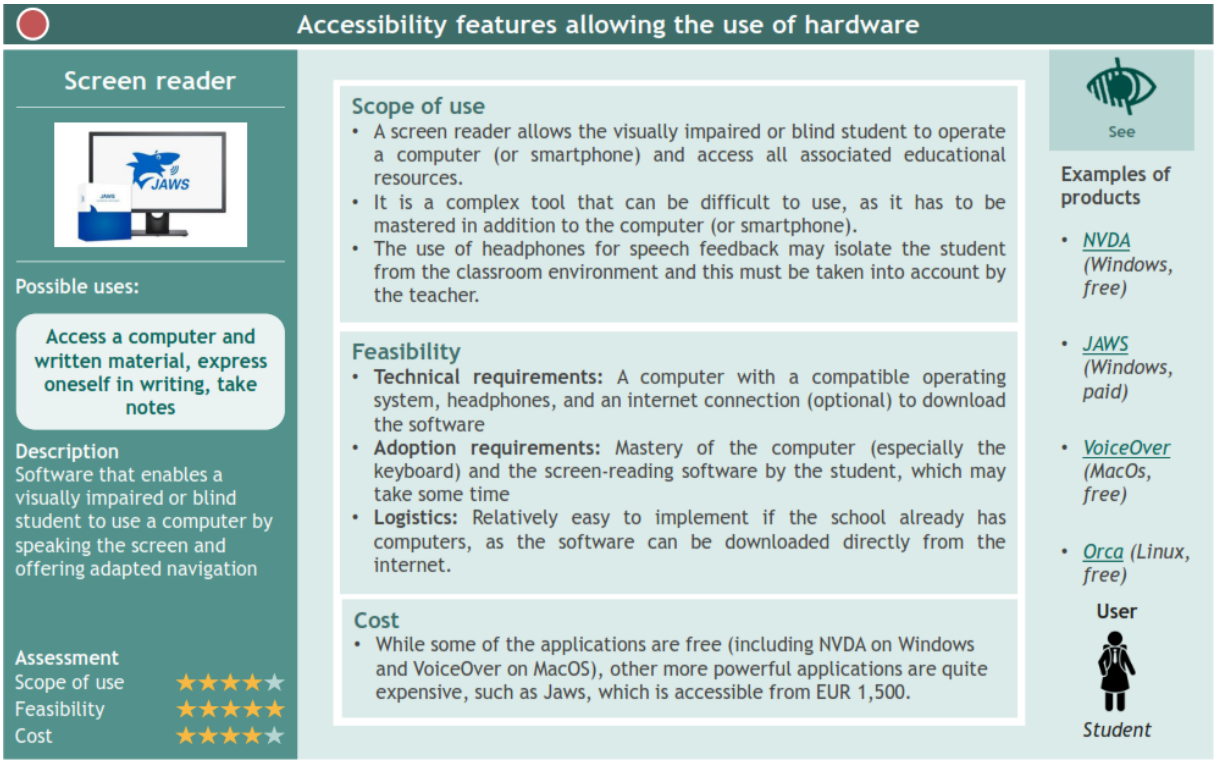
- Distinction between **educational content/activities** and **means of access to educational content and activities**
- Distinction between **mainstream, accessible and specialised ICTs**



4. Standardised ICT Presentation Sheet

4.1 Overview

The ICT Directory for Inclusive Education presents ICTs that have been identified during the study as having the potential to support the educational inclusion of children with disabilities. The directory consists of **standardised presentation 'sheets' for each ICT**. They are structured as follows:



Some ICTs (e.g. computers) **appear in several sections of the directory**. This is because the same ICT can support the inclusion of students with different types of difficulties. While the ICT is the same, **the sheet is different and highlights the most suitable products/functions depending on the disability of the child** using it.

The ICT Directory for Inclusive Education does not claim to be exhaustive, but presents major ICTs that have the potential to advance inclusive education.

4.2 ICT Assessment

Each sheet of the directory includes an ICT assessment based on:

- An analysis of the **scope of use** of the ICT, i.e. the educational content and activities, the means of access the ICT gives the child, the versatility of the ICT, etc. For instance, a screen reader is very useful for a blind child by allowing him or her to read, whereas a specialised game for the blind is not as useful in daily life;
- An analysis of the **feasibility** of the ICT, i.e. the possibility of using it in the context of the country of intervention. This section also indicates **technical requirements** (equipment needed for use, access to the internet, to electricity, etc.), **requirements for using the ICT** in schools (French language skills, learning curve, teacher training, etc.) and **logistical information** on the acquisition of the ICT (availability in the country/possibility of importing it, etc.);

- An analysis of the **cost** taking into account other elements in order to assess the impact/price ratio of the technology identified.

4.3 Examples of products/sources

This section of the sheet contains links for easy access to:

- The **websites providing the resources** (for educational content or activities);
- The **manufacturers/vendors of the product** (for hardware or accessibility features).

In addition, at the end of some sections, there is a 'library' slide with **different sources of educational content and activities** accessible to children with the type of difficulty studied in the section.

4.4 ICT user

While the ultimate beneficiaries of the ICTs are children with disabilities, they are not necessarily the users. For example, a Braille printer allows a blind child to access written educational content but is used by the teacher to print out an exercise and make it accessible to the blind student. This distinction is important because **the adoption requirements are directly related to the user** (e.g. the level of literacy required to use the ICT) and to the **cost** of the ICT for a programme that wants to acquire it (e.g. it is much cheaper to provide one Braille printer per school to be used by teachers than to provide a Braille tablet to every blind student). The user of the ICT is therefore indicated on each of the sheets of the directory.

4.5 Other ICT uses

At the end of the sections dedicated to the different difficulties, we have a section entitled '**Other ICT uses**'. In addition to providing access to educational content and activities for children with various difficulties, ICT can also be used to **train teachers in inclusive education**, **help them identify the difficulties encountered by children** and find solutions, **connect with a specialised teacher/health professional** in order to get advice on necessary adaptations, **enable the school to have access to electricity** via an off-grid energy operator (solar panels associated to a SIM card and a telephone), etc. All these aspects contribute to improving the educational inclusion of children with disabilities and are presented in this final section of the directory.

ICT Directory for Inclusive Education

The ICT Directory for Inclusive Education is available here: [ICT Directory for Inclusive Education | (asksource.info)]. Below are a few extracts from the directory.

1. Visual impairment > Accessibility > Blitab

Hardware allowing access to educational content or activities

Blitab

Possible uses:

Access educational content, communicate in writing

Description
Blitab is a tablet computer with a touchscreen and a 14-line Braille display. It transcribes the content displayed on the touchscreen into Braille (whether it is a text document, a web page or an application).

Assessment

Scope of use	★★★★★
Feasibility	★★★☆☆
Cost	★★☆☆☆

Scope of use
- The Blitab Braille tablet allows the student to quickly interpret content sent by the teacher through a Braille display, even when the content is not in a text format.
- It is a stand-alone personal tool designed for education and access to school for visually impaired and blind children: the tablet computer converts any document into Braille and offers tactile navigation.
- It is designed to be inclusive and is an option to be considered for school inclusion in the countries of intervention, as it is affordable compared to other resources.

Feasibility
- **Technical requirements:** Power supply, an internet connection (optional), headphones for speech synthesis and navigation.
- **Adoption requirements:** Knowledge of Braille by the visually impaired student; familiarity with the tool, which may take a few days for complete mastery
- **Logistics:** This equipment is not available in the countries of intervention and must be imported from the manufacturer.

Cost
- The Blitab tablet costs approximately EUR 465.

See

Resource website:

- *Blitab*

Another Braille touchscreen tablet:

- *InsideONE*

User

Student

Educational content and activities

Educational videos in sign language

Possible uses:

Access educational content and activities

Description
Educational videos (stories, nursery rhymes, lessons on a specific topic...) with sign language interpretation

Assessment

Scope of use	★★★★★
Feasibility	★★★★☆
Cost	★★★★★

Scope of use
- Educational video on a topic of your choice with sign language interpretation
- However, not all videos have the same level of inclusiveness. Some are fully inclusive and use different methods of communication (audio, text, sign language and images). They can be projected in an inclusive classroom to give all students - including hearing impaired and deaf students - simultaneous access to the same content.
- Others, however, are only available in sign language, making their use more problematic in an inclusive classroom as some students would not be able to follow.
- Moreover, there are still relatively few videos in LSF.

Feasibility
- **Technical requirements:** A computer/tablet or smartphone, a video projector, an internet connection (or videos downloaded in advance)
- **Adoption requirements:** Computer/tablet/smartphone skills for the teacher
- **Logistics:** The videos are available on the web.

Cost
- Many videos are available for free. However, some of the videos are paid.

Hear

Examples of content

- *eKitabu (fully inclusive videos, but not available in French)*
- *L'école en LSF avec Bastien (videos with LSF + audio)*

User

Student

Software for access to educational content and activities[1]

Alternative communications software and applications

Possible uses:

Communicate with the teacher and students, express oneself orally

Description

These software and applications make it easier to communicate and express oneself orally thanks to an alternative language that uses images/symbols for instance, the meaning of which is then spoken.

Assessment

Depends on each software or application

Examples

Proloquo2Go
iPad app

Proloquo2Go is an application that allows students with communication difficulties (cognitive and/or speech difficulties) to express themselves. The student selects images/symbols representing what they want to express, and the application speaks them. The interface can be customised according to the language needs of the student. The resource has been available in French since 2016 at a price of EUR 249, on iPad only.

SymWriter
Software

SymWriter is an adapted word processing software that combines alphanumeric characters, images, pictograms and speech synthesis. It is primarily intended for people who use picture-based communication due to cognitive impairment, specific language impairment, or autism spectrum disorder. The software has many features and an expandable bank of 8,000 images covering all levels.

Communicate

User

Student

Educational content and activities

Les Langagiciels

Possible uses:

Learn how to read and write

Description

Les Langagiciels is an educational software suite developed by the association EcLire. It is a reading and writing tool adapted to the needs of children who have difficulty concentrating, memorising and learning.

Assessment

Scope of use ★★★★★
Feasibility ★★★★★
Cost ★★★★★

Scope of use

- *Les Langagiciels* proposes activities and exercises adapted to the needs of students with learning difficulties. For French, for example, there are 6 programs for the acquisition of basic reading and writing skills (segmentation of a text, anticipation, etc.).
- The developers consider that the acquisition of reading and writing skills is best achieved through group work. *Les Langagiciels* is therefore designed with group work in mind, and students work on the computer in pairs.
- The teacher uses this tool to define tasks to be carried out by the students (e.g. using an example to construct a simple sentence) according to their abilities and needs.

Feasibility

- **Technical requirements:** A computer, power supply, and optionally an internet connection to download the software
- **Adoption requirements:** Mastery of the tool by the student, which requires several days of practice, and involvement of the teacher
- **Logistics:** This software suite can be downloaded directly from the resource website.

Cost

- This is a free resource.

Learn

Resource website

- *Les Langagiciels*

User

Student

Accessibility features allowing the use of hardware

Trackball mouse

Possible uses:

Use a computer

Description
The trackball is a pointing device that uses a rolling ball to control the movements of the cursor (and perform clicks). It replaces the conventional mouse.

Assessment
Scope of use ★★★★★
Feasibility ★★★★★
Cost ★★★★★

Scope of use

- Using a mouse (which is necessary to operate a computer) is not always possible for a person with a motor disability in the upper limbs (inability to hold the mouse, inability to click, etc.).
- A tool such as a trackball can be used as a substitute for the mouse to make things easier.
- There are also joysticks that perform the same function; the choice of the equipment depends on the specific needs of the student.

Feasibility

- **Technical requirements:** Computer and power supply
- **Adoption requirements:** Student's ability to use a computer
- **Logistics:** Generally not available in the countries of intervention - must be imported from specialist manufacturers

Cost

- A trackball usually costs at least EUR 100, which must be added to the price of the computer.

Move

Examples of products:

- *Big Track (Genius Kye Systems)*
- *Orbit Optical Trackball (Kensington Computer)*
- Trackman Marble (Logitech)

User

Student

Teacher training

TheTeacherApp

Objectives:

Train teachers

Description
TheTeacherApp is a free application developed in India to help teachers learn and improve their skills.

Assessment
Scope of use ★★★★★
Feasibility ★★★★★
Cost ★★★★★

Scope of use

- TheTeacherApp aims to complement teacher training with free, easy-to-use course content that can be downloaded from anywhere.
- One of the barriers to inclusive education is the lack of information about the abilities and needs of students with disabilities. There are simple practices and educational methods that make schooling accessible to students who have difficulty seeing or hearing, for example.
- The application also provides access to experts on the Indian education system and can be used to share experiences with other teachers in the country and keep abreast of successful teaching innovations, methods and resources.
- This model holds great promise for inclusive education; it addresses the urgent need to train teachers to welcome and accommodate children with disabilities in mainstream schools.

Feasibility

- **Technical requirements:** A smartphone and internet access
- **Adoption requirements:** None
- **Logistics:** The application can be used anywhere.

Cost

- This application is free

Other

Resource website:

- *TheTeacherApp*

User

Teacher

Selection of the most relevant ICTs for the target countries of the study and examples of uses

1. Criteria for the selection of the ICTs

The ICT Directory **identifies a large number of technologies that facilitate access to inclusive education for children with disabilities**. However, there are **prerequisites for their proper use**. Generally, using ICTs in schools requires:

- A **budget** to meet the cost of the technologies
- **Access to electricity** to operate or recharge the equipment
- **Internet access**, as many of the technologies identified are online
- A **good level of digital skills** in order to use the equipment correctly
- A **certain level of literacy**, which is essential for acquiring digital skills.

Despite constant progress in recent years, **these requirements are still far from being met everywhere in the target countries of the study** (Benin, Burkina Faso, Madagascar, Mali, Morocco, Niger, Senegal and Togo).

Potential barriers to the use of ICT in schools in the target countries of the study

Country	GDP/capita (USD)[5]	% of literate adults (15+)[6]	% of people with access to electricity[7]	% of individuals with at least one mobile phone[8]	% of individuals using the internet[9]	% of the population covered by 3G[10]
Benin	1219	42%	42%	53%	14%	46%
Burkina Faso	775	41%	14%	42%	16%	65%
Madagascar	522	75%	26%	33%	5%	34%
Mali	891	35%	51%	66%	13%	36%
Morocco	3204	74%	100%	67%	74%	90%
Niger	555	35%	18%	31%	5%	18%
Senegal	1447	52%	67%	64%	30%	50%
Togo	676	64%	51%	40%	12%	39%

The most **appropriate ICTs should therefore be selected** for use in the schools of the target countries of the study, **taking into account the local context**.

To allow this selection, all the ICTs in the directory were rated from one star (poor) to five stars (very good) according to three main criteria:

[5] World Bank, 2019.
[6] World Bank, 2018.
[7] World Bank, 2018.
[8] GSMA Intelligence, 2020 forecast; number of mobile subscriptions divided by the total population.
[9] World Bank, 2017 to 2019 depending on the country (latest available data).
[10] GSMA Intelligence, 2020 forecast.

- **Scope of use:** measures the interest of the ICT and its versatility, i.e. the number of educational content or activities that the ICT makes accessible to the child. This criterion also allows for a better assessment of the cost of ICT relative to the opportunities it offers.
  Scoring example:
  1 star: A specialised game accessible for visually impaired or blind children (access to a single game).
  5 stars: a screen reader that allows the child to access any written document as long as it is scanned, and allows him or her to use a computer, a phone, a tablet, etc.
- **Feasibility**: assesses how realistic it is to consider using this ICT in the schools of the target countries. Feasibility is assessed according to three sub-criteria that take into account the barriers to ICT use in the above-mentioned target countries.
  - **Technical requirements:** material conditions for the use of the ICT. This includes, for example, access to electricity, access to the internet, acquisition of hardware or software, etc.
  - **Adoption requirements:** skills required to use the ICT. This may include the level of literacy required in a certain language, whether or not specific training is needed to use the ICT, how difficult it is to achieve proficiency, etc.
  - **Logistics:** possibility of procuring the ICT locally (availability on the local market, possibility of importing it, etc.).

  Scoring example:
  1 star: an ICT that needs to be permanently plugged into the mains, that requires high-speed internet access, a state-of-the-art computer with several applications, an ICT that requires specific training to use it independently and is not available locally.
  5 stars: a battery-powered ICT (doesn't have to be permanently plugged into the mains), that can be used offline, is user-friendly, and is available locally.
- **Cost:** assesses the cost of the item/resource taking into account the potential impact/price ratio of the ICT.
  1 star: A Braille notebook that costs several thousand euros.
  5 stars: Free inclusive educational videos

2. ICT selection

For each type of difficulty, the table below shows **the ICTs in the directory that seem the most relevant** – according to the above criteria – for use in the countries of the study, and gives the rationale for the selection. ICTs not available in French have been excluded from the selection.

Visual impairment

ICT category	ICT name	Assessment	Rationale
Means of access	Computer	• **Scope of use: 5/5** • **Feasibility: 4/5** • **Cost: 3/5**	High cost, but high potential Allows access to inclusive educational content or activities (free resources are often digital), and makes mainstream content accessible Need for inclusive computers with accessibility features
Means of access	Standard projector	• **Scope of use: 4/5** • **Feasibility: 4/5**	Allows visually impaired students to better see the teaching material used by the teacher. Also provides

ICT category	ICT name	Assessment	Rationale
		• **Cost: 3/5**	reading/viewing comfort for all students. Moreover, a projector allows the teacher to project any digital resource from his or her computer (enabling all students to benefit from these resources, even if only one computer is available for the teacher.
Means of access	Smartphone	• **Scope of use: 4/5** • **Feasibility: 3/5** • **Cost: 4/5**	A smartphone allows a visually impaired student to use software/applications to access written material. When no computer is available or when a computer cannot be used on a daily basis in the classroom, a smartphone allows a student to use a magnifying glass or screen reader to read a document, to use the phone's recorder to take notes, to read an audio book, etc. It is a good assistive technology for visually impaired students in the absence of a computer in the classroom.
Means of access	Transcription software + Braille embosser	• **Scope of use: 5/5** • **Feasibility: 4/5** • **Cost: 1/5**	Despite their high cost, transcription software and a Braille embosser are essential to enable teachers to produce educational content in Braille. Due to their cost, centralised use can be considered (e.g. one printer per region for teachers' use).
Means of access	Digital recorder (or recording app on a phone)	• **Scope of use: 3/5** • **Feasibility: 5/5** • **Cost: 4/5**	Inexpensive technology used by many blind children to record lessons from teachers. Those with Braille writing devices at home (heavy equipment that often cannot be taken to school) can then listen to the lesson again at home and take notes on the Braille writing device. The others can simply listen to the course again to memorise it.
Accessibility feature	Keyboard (+ smartphone)	• **Scope of use: 5/5** • **Feasibility: 4/5** • **Cost: 4/5**	A standard keyboard allows a blind student to use a smartphone in the same way as a computer and take notes. A smartphone used with a keyboard therefore allows the child to access written material thanks to the smartphone's screen reader and to express themselves in writing (taking notes, submitting assignments, etc.) using the keyboard. For visually impaired or blind students, it is a 'lighter' alternative to a computer in the classroom.
Accessibility feature	Magnification/screen reading features	• **Scope of use: 4/5** • **Feasibility: 5/5** • **Cost: 4/5** *Depending on features*	More and more computers/tablets/smartphones have these features built in, otherwise they can be installed for free (at least some versions). They make the computer/tablet/smartphone accessible to the visually impaired and greatly increase access to educational content and activities for these students.
Educational content or activity	Audiobooks	• **Scope of use: 3/5** • **Feasibility: 5/5** • **Cost: 5/5**	This format is particularly useful for visually impaired students; it allows them to access textbooks, literary texts, entertaining books, etc. Free resources are available in French.

Hearing impairment

ICT category	ICT name	Assessment	Rationale
Means of access	Speakers	• **Scope of use: 4/5** • **Feasibility: 4/5** • **Cost: 4/5**	Simple technology that improves access to spoken content for hearing-impaired children and is also useful for other students sitting far from where the teacher is. It is particularly useful in rural areas where there are large classrooms with many students.
Means of access	Authôt	• **Scope of use: 3/5** • **Feasibility: 3/5** • **Cost: 5/5**	A simple and free application that allows teachers to make any oral content used in class (video, audio, etc.) available in written form and accessible to hearing-impaired students.
Educational content or activity	French-LSF dictionary	• **Scope of use: 4/5** • **Feasibility: 4/5** • **Cost: 5/5**	A free resource with a strong potential for inclusion. It educates teachers and students about sign language and teaches them some basic skills. It also allows deaf or hard-of-hearing students to build their vocabulary (in sign language) when the teacher uses new words.
Educational content or activity	Sign language learning material	• **Scope of use: 5/5** • **Feasibility: 4/5** • **Cost: 5/5**	See above.

Communication difficulties

ICT category	ICT name	Assessment	Rationale
Means of access	Speech synthesis and alternative communication software	*Depending on the solution chosen*	These technologies are relatively inexpensive and have great potential for the inclusion of students who cannot use verbal language; they can use them to communicate with the teacher and their peers.

Difficulty remembering/concentrating/learning

ICT category	ICT name	Assessment	Rationale
Means of access	Open Dyslexic font	• **Scope of use: 4/5** • **Feasibility: 4/5** • **Cost: 5/5**	A font downloadable for free; it can be easily used by the teacher and students to facilitate reading and writing for dyslexic students.

Difficulty moving upper limbs

ICT category	ICT name	Assessment	Rationale
Means of access	Computer	• **Scope of use: 5/5** • **Feasibility: 3/5** • **Cost: 3/5**	A computer enables students with fine motor difficulties to write (take notes, hand in written assignments, etc.) and is therefore important for their inclusion in a classroom.
Means of access	CiviKey	• **Scope of use: 5/5** • **Feasibility: 3/5** • **Cost: 5/5**	A free resource with great potential; it enables students with fine motor difficulties to use a computer and access digital content.

Other ICT uses

ICT Objective	ICT name	Assessment	Rationale
Access to electricity	Off-grid energy (solar panel + mobile money)	• **Scope of use: 5/5** • **Feasibility: 5/5** • **Cost: 5/5**	Essential for power supply in the classroom, a prerequisite for the use of the vast majority of ICTs.
Raise awareness, inform	The radio, social networks and internet resources	• **Scope of use: 5/5** • **Feasibility: 4/5** • **Cost: 2/5** *Depending on the media chosen*	ICT has a great potential to raise awareness of disability among parents, teachers and students, and lack of awareness remains one of the major barriers to the inclusion of children with disabilities in schools.
Diagnose, support	Telemedicine application	• **Scope of use: 3/5** • **Feasibility: 4/5** • **Cost: 4/5**	Medical support is essential to identify children's needs and provide them with appropriate ICT to maximise their inclusion. Telemedicine brings parents, teachers and children closer to medical professionals, who are often in short supply in the countries of intervention.
Train teachers	Training application	• **Scope of use: 5/5** • **Feasibility: 5/5** • **Cost: 5/5**	The lack of proper training of teachers in inclusive education remains one of the major barriers to the inclusion of children with disabilities in schools. ICT allows for remote continuing education for teachers.

3. Examples of ICT initiatives for school inclusion

During the study, some **school-based ICT initiatives** for middle- and low-income countries were identified. They show **how ICTs can be used to promote the educational inclusion of children with disabilities when they are well suited to the local context**. Not all the ICTs identified have been developed specifically for children with disabilities, but new technologies give them a potential for inclusion.

Case study – Kenya – iPad, screen readers and keyboards enable blind students to continue their education[11]

In Kenya, blind students from the Thika Special School often find it **difficult to pursue higher education**, as Kenyan universities and colleges are not very inclusive. Through a partnership between the Thika School for the Blind (Kenya), Kenyatta University (Kenya) and Syracuse University School (USA), an **assessment of the needs of blind students** was conducted to identify **technologies that could help them go to university**. Following this diagnosis, **iPads with the VoiceOver screen reader** and **keyboards** were distributed to the students, and they were **trained** to use the screen reader. This programme has enabled blind children to **access university material autonomously** and has **significantly improved their access to higher education** in Kenya.

Case study – Senegal – The inclusive digital libraries of Nouvelles Éditions Numériques Africaines

Nouvelles Éditions Numériques Africaines (NENA) wants to use technology to **make books and textbooks available to students**. NENA has observed that schools in Africa usually do not have libraries, and the few libraries that exist are poorly supplied. As a result, NENA has decided to develop **virtual libraries**. Books can be accessed in two ways:

- **Offline model:** schools (or other organisations) acquire eReaders (devices for reading digital books) that students can borrow to access the books.
- **Online model:** students go directly to the online platform to borrow or buy books.

In an effort to be accessible to all, NENA has already **recorded audio versions of 150 of its 3,000 books** and has recently released its **first accessible EPUB 3 book**. Through a crowdfunding campaign in partnership with the Islamic Development Bank, NENA intends to **continue to produce accessible books** (i.e. with an audio version, easy navigation, etc.), make them available in its digital library, and encourage other publishers to produce accessible books.

Several schools in Dakar have opted for the offline model and some Senegalese universities have subscribed to the online library. With its accessible books, NENA plans to reach more than 160 primary and secondary school students at INEFJA (Institut National d'Éducation et de Formation des Jeunes Aveugles), 120 visually impaired or blind students at Cheikh-Anta-Diop University, as well as several other structures (public schools, associations, NGOs, etc.) working with the visually impaired.

For more information: http://nena-sen.com/

[11]Toolkit on Disability for Africa – Inclusive Education, Division for Social Policy and Development (DSPD) and Department of Economic and Social Affairs (DESA), United Nations.

Case study – Egypt – A virtual laboratory for students to conduct scientific experiments

Virtual chemistry experiment on Vlaby

Few schools in Africa have laboratories where students can carry out **scientific experiments** (chemistry, physics, biology, etc.). Moreover, because of the lack of equipment, chemicals and teacher training, such experiments cannot be carried out safely. As a result, **science education often remains purely theoretical** for many children. **Vlaby** is an **Egyptian startup** that has created a virtual laboratory allowing teachers to **safely conduct experiments with their students, even when the school has no equipment**. The solution is currently based on Egyptian and Middle Eastern curricula.

This solution **was not designed specifically for children with disabilities**. However, these children face **many difficulties in learning science subjects** and carrying out educational experiments. This solution could eventually make science education more inclusive (some work on inclusiveness is still necessary).

For more information: https://www.vlaby.com/public/en

Case study – Chad – Improving access to course materials by making them available in text or mp3 format on mobiles/tablets/computers for the visually impaired

A student following a course on a textbook while another is using his tablet where the course has been downloaded. Credit: UNICEF Chad.

According to a report on the education system, Chad is one of the countries in Africa with the fewest textbooks, with almost 80% of students not having books. TchadEducationPlus is a UNICEF-funded pilot project that aims to **improve access to course materials for primary and secondary school students** through digital and mobile technology. The project collects the **best course materials** from schools around the country and **turns them into digital books** (PDFs) that can be **downloaded free of charge** from the project's platform and then stored and accessed on a mobile phone (or a tablet or computer) as stand-alone applications. The lessons can be easily sent to other students via Xender or Bluetooth.

In order to make this work accessible to all, the project recently launched **TchadEducationPlus NonVoyant** that converts lessons into **mp3 files**. The courses are free to download and can be easily listened to and transferred using a phone.

Digitised courses in text format are currently available for students from 3ème to Terminale, with the objective of covering all secondary school levels in the near future. TchadEducationPlus NonVoyant is still developing its mp3 courses. Only a few courses are currently available on the platform.

For more information*: http://www.tchadeducationplus.org/accueil.html and http://www.tchadeducationplus.org/projet-audio-non-voyant.html*

Case study – Togo – An offline virtual library for easy access to digital educational resources

Kekeli Lab is a Togolese company that has created the *Kekelithèque*, a virtual library giving access to digital content. It is a **box containing a wide range of digital educational resources**. Users – teachers and students – can **access the Kekelithèque from a close distance** with a phone, tablet or computer. A system similar to Bluetooth allows users to connect to the Kekelithèque and access its content. Those who have **an internet connection** can **add documents to the Kekelithèque** and the documents will be visible to all.

A Kekelithèque box and a student accessing its educational content with his phone

Although it was not specifically designed for people with disabilities, the Kekelithèque **makes digital content accessible, even in areas without an internet connection**, thus allowing the teacher to easily use various teaching materials to address children's difficulties (audio material, text that can be enlarged with a magnifier on a phone/tablet/computer to facilitate reading, etc.).

For more information*: http://kekelilab.education/*

Case study – Kenya – Improving the accessibility and reducing the cost of educational materials with eKitabu

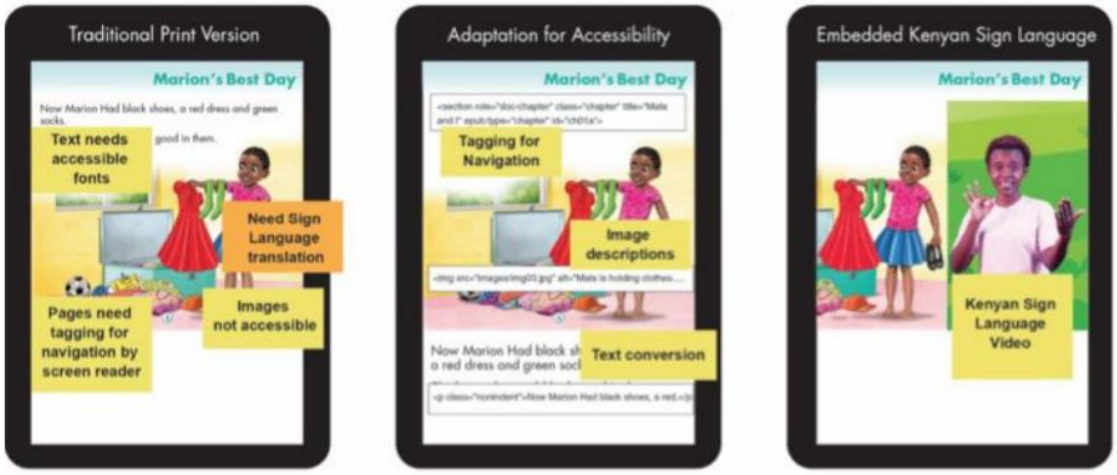
eKitabu is a Kenyan social enterprise founded in 2012 with a mission to **make educational materials accessible to as many school children as possible**. Its strategy is based on two core principles:

Digitisation of materials in accessible formats (EPUB 3 and WCAG 2.0) so that they can be read by visually impaired children using screen readers. eKitabu has also developed its own software, the eReader, which can be downloaded free of charge and which allows access to books in accessible formats (contrast can be changed, text can be enlarged, content can be read with a screen reader, etc.);

eKitabu's KSL studio director testing the content with a child

- **Use of sign language versions of various educational materials** to make them accessible to hearing impaired and deaf children. To this end, eKitabu has set up its own studio in 2019, the **Kenya Sign Language Studio**, which allows for a **cost-effective creation of sign language content**. The studio is also open to publishers who wish to make their content accessible to the deaf and hard of hearing at a reasonable cost.

The eKitabu concept: on the left, conventional non-accessible text (no accessible font, no easy navigation features, no description of images, no sign language); in the middle, the content is made accessible for the visually impaired thanks to navigation features, image description, and the possibility of changing the colour or size of the text; on the right, sign language interpretation added to a video.



eKitabu has built up a library of over **300 school books for children of all ages based on the official curriculum of the Kenyan Ministry of Education**. Many of these books are available free of charge. Other eKitabu products include paid **Kenyan Sign Language (KSL) learning videos**, as well as **accessible educational videos** (also paid). Building on its success in Kenya, eKitabu is expanding internationally and its KSL studio now also offers **Rwandan Sign Language (RSL)**, **Malawian Sign Language** and **Tumbuka Sign Language interpretation**. Other projects have been developed building on the accessible content created by eKitabu. Thus, in 2018–2019, a pilot project **integrated the content of eKitabu books into an Orbit Reader**. Blind students could then **access the content in Braille** (the Orbit Reader converted the accessible text and displayed it in Braille). 1,500 Orbit Readers with eKitabu accessible content were distributed in three countries (Kenya, Tanzania, Malawi) for the pilot phase. For more information*:* *https://www.ekitabu.com/*

A student using an Orbit Reader to read a Braille version of an eKitabu accessible book saved in the reader

Kenya, Uganda, Rwanda, Nicaragua, Paraguay and Uruguay

Case study – Kenya, Uganda, Rwanda, Nicaragua, Paraguay and Uruguay – UNICEF's Accessible Digital Textbooks (ADT)

UNICEF is currently piloting the development of **accessible digital textbooks in six countries** using **Universal Design for Learning (UDL) principles**. Keeping to the curricula of the different countries, UNICEF is developing **accessible digital content and learning activities for different grades**, allowing **all children in a class, regardless of their difficulties, to access the same content** from the same digital textbook. The content will be available in written form, but also in audio format (for the visually impaired), in sign language interpretation (for the hearing impaired), with pictures (for students with reading or comprehension difficulties), etc. The project will be piloted in six countries in 2019, 2020 and 2021.

Deaf students using an accessible digital textbook in sign language, while other students in the background are reading out the text.

An accessible digital textbook developed in Paraguay as part of the UNICEF project. The keys at the bottom left of the page allow children to choose their preferred mode of access to the content (sign language, plain language, or audio).

To access the book: https://www.mec.edu.py/dua/book.xhtml#nothing

For more information*:* *https://www.accessibletextbooksforall.org/*

Case study – Bangladesh – Ideas Box, the portable and accessible multimedia centre[12]

Ideas Box is a **portable, all-in-one multimedia centre** that includes various **manual and digital activities for educational, social and cultural development**. The content can be customised to suit the learning environment and the learner's socio-demographic profile. It includes a **wide range of resources for learners with different levels of language proficiency** to support the academic and social development of the child. Using stories, symbols, photographs, various sensory activities, accessible materials and tablets, Ideas Box (created and distributed by Bibliothèques Sans Frontières) creates **a supportive environment to build confidence and enhance language and literacy development**. To enable access by learners with disabilities, Ideas Box uses **assistive technologies, accessibility features** for tablets, applications that facilitate communication, subtitled video content, etc. The activities also **allow teachers and assistants to train** at the same time. **Learners can interact** through games and activities, enabling them to acquire a variety of skills and **overcome language barriers**. Finally, through the participation of both learners and families in the activities, Ideas Box contributes to strengthening communities, particularly in the refugee camp of Cox Bazar (Bangladesh) where it has been used.

Ideas Box

For more information*: https://www.librarieswithoutborders.org/ideasbox/*

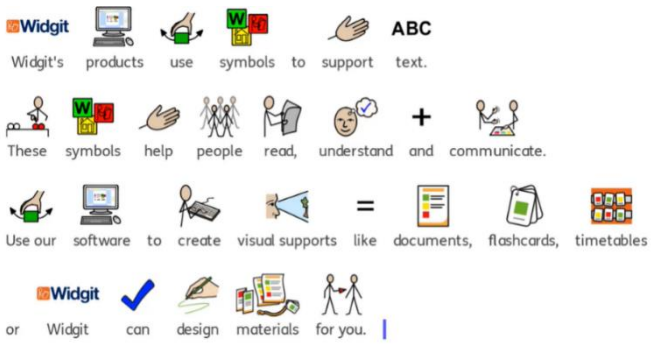
Rwanda, Ethiopia, Bangladesh, Gaza Strip

Case study – Rwanda, Ethiopia, Bangladesh, Gaza Strip – Facilitating communication through the use of symbols[13]

Widgit is **a symbol-based communication tool** that enables **communication across language barriers**. Using symbols that can be customised for any environment, socio-demographic profile or culture, it allows individuals to **expand their vocabulary, improve their understanding of concepts, and communicate complex ideas or thoughts**. *Widgit* includes a variety of symbols associated with concepts, which are used to improve understanding, literacy, and communication in general. In a mainstream education context, **the teacher uses *Widgit* on a computer to convert text into symbols**. These symbols can then be used, either in printed format and distributed to the class, or directly on the children's tablets for an **easier understanding of the words and ideas associated with the symbols**. The software **promotes the participation of children, whatever their level of language acquisition, and enables a better inclusion of children with disabilities**.

[12] Case study conducted by Julia Mills through an interview with Jodie Nguy, Inclusive Education Specialist, Humanity & Inclusion

[13] Case study conducted by Julia Mills through an interview with Vincent Murenzi, Inclusive Education Project Manager, Humanity & Inclusion.



Converting text into symbols with *Widgit* and using printed symbols to facilitate communication in the classroom

For more information: https://www.widgit.com/

In 2020, the global **COVID-19** pandemic forced many countries to close their schools. **ICT was then one of the few solutions for maintaining educational continuity**. Below are examples of **initiatives that enabled children with and without disabilities to continue their education despite not being physically present in school**.

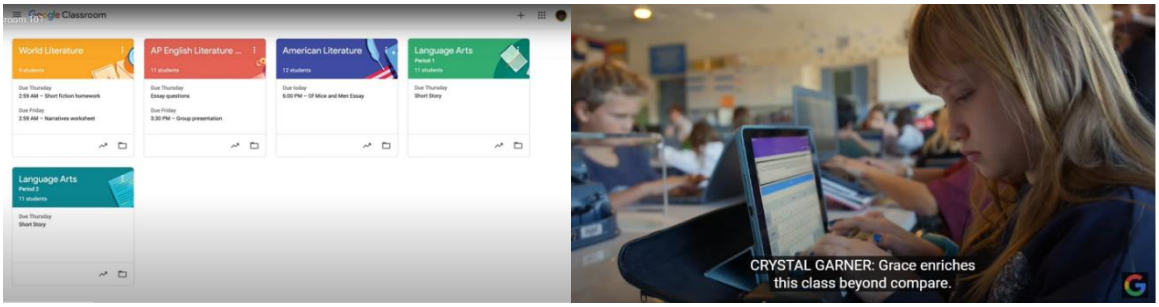
Case study – Example 1: Using an accessible virtual working environment

With the closure of schools, many countries turned to distance learning. Technology therefore played a key role in ensuring educational continuity. The most privileged students were able to continue to learn through **virtual working environments**. The most advanced of these, such as **Google Classroom[14],** allow you to recreate the virtual classroom environment virtually. In practical terms, the teacher creates a virtual workspace where he or she shares content, gives exercises and instructions for homework, distributes exam topics, etc. Students can access all these documents, write to the teacher, and hand in written assignments directly on the platform. It is also possible to schedule video calls (for example, to give a lesson by videoconference) and to have live written discussions with the teacher. Google Classroom has a number of accessibility features such as compatibility with Braille screen readers and displays, contrast change, text magnification, mono audio, voice recognition, etc. A **Chromebook computer** is particularly suitable for accessing Google Classroom, as it has many accessibility features that are fully compatible. During the pandemic, **Google Classroom can make all classroom documents and activities accessible to all students in virtual classroom environments**.

[14] Google Classroom presentation video in English: https://youtu.be/UEFgW--0094

On the left, a Google Classroom interface with different courses by subject; on the right, a blind student using a computer and a Braille display to access Google Classroom. The voice command and screen reader allow her to navigate Google Classroom and she uses the Braille display to read in Braille the documents that the teacher has placed in the virtual classroom. Her sighted classmates are doing the same work on computers.

A video of the same blind student using Google Classroom:
https://www.youtube.com/watch?v=4j5-7xQ_7qM



Although this solution is effective and inclusive, it is unfortunately unaffordable for many children because it requires electricity, an internet connection, expensive assistive technology, trained teachers, etc.

Case study – Example 2: Using the radio or television to broadcast lessons for as many children as possible

Where computers and the internet are not widely available, governments generally turn to **traditional ICTs such as the radio, television and mobile phones** (phones without internet, which rather use SMS, USSD or IVR – a technology for voice messaging). The **variety of materials** (audio lessons on the radio, lessons on television with video, sound and subtitles, text messages (SMS), audio messages (IVR)...) **allows for a better inclusion of children with disabilities who can choose the distance learning method that suits them the most**. Examples of initiatives include the broadcasting of courses on television in Mauritius[15], the 'National Online School' in Ukraine[16] that broadcast courses for different age groups on YouTube, Facebook and national TV channels at set times, the broadcasting of courses on the radio in Guatemala[17] and Burkina Faso[18], etc. Educational applications have also played an important role. **The educational videos broadcast on the internet or on television invite the child**

Ubongo Kids numeracy video broadcast on the internet and on television

[15] https://www.maurice-info.mu/2020-04-05-lecole-a-la-tele.html
[16] https://www.unian.info/society/10936646-ukraine-launching-national-online-school-project.html
[17] https://www.edm.ch/fr/media-publication/actualites/covid-19-des-lecons-a-la-radio-pour-les-eleves-du-guatemala
[18] https://www.rfi.fr/fr/podcasts/20200518-burkina-faso-quand-l-%C3%A9cole-passe-la-radio

to interact and answer questions, give feedback, ask questions, etc. **by sending an SMS or a voice message** (IVR). Ubongo kids in Tanzania (which offers content in English, Kiswahili, and French)[19] or Enaza[20] in Kenya, Rwanda, Ghana and Côte d'Ivoire are examples of such educational applications.

Although **most of these materials have not been designed to be inclusive, the variety of educational materials offers many options** for students with disabilities and their families and thus maximises their chances of continuing their education, even at a distance, by choosing the option most adapted to their needs.

The case study below illustrates **how ICTs were used in Lebanon and the Palestinian Territories** initially for the inclusion of isolated children, but also to enable classes to continue during the COVID-19 pandemic.

Case study – Lebanon and the Palestinian Territories – Distance learning with tablets[21]

Initially intended for students living in rural or remote areas, **tablets** played a key role in **distance learning** during the COVID-19 pandemic by allowing access to education.

The use of tablets for education is currently being tested in about 30 public schools in Lebanon.

A schoolboy using a tablet, and a screenshot of a lesson with sign language interpretation available on YouTube for schoolchildren in the Palestinian Territories

The schools have received tablets from Humanity & Inclusion and **teachers can create customisable content for online lessons**. **The content created can then be made accessible** with subtitles and sign language interpretation. The Ministry of Education has created a virtual working environment where the resources created can be accessed. Similarly, in the Palestinian Territories, teachers have created **a YouTube channel with lessons that include sign language interpretation** so that as many students as possible can continue their education through ICT, despite the pandemic.

For more information: Working environment in Lebanon – https://dl.crdp.org/; YouTube channel in the Palestinian Territories – https://www.youtube.com/channel/UCGzqOe7IhOqHI4eOaetbObQ/videos%20)?app=desktop

[19] https://ubongokids.com/
[20] https://enezaeducation.com/
[21] Case study conducted by Julia Mills through an interview with Henriette Chidiac, Inclusion Technical Advisor, Humanity & Inclusion

4. Challenges to the use of ICT in classrooms in the target countries

The study identified a number of **challenges to the use of ICT in inclusive classrooms** in the target countries. HI will take these barriers into account in future programmes on the use of ICT for inclusive education.

Note: other more general barriers are not mentioned here but are also very present. This is the case for the discrimination/stigmatisation that children with disabilities face. Some parents, teachers and students may consider that ICT is too complex and expensive and is not appropriate for persons with disabilities.

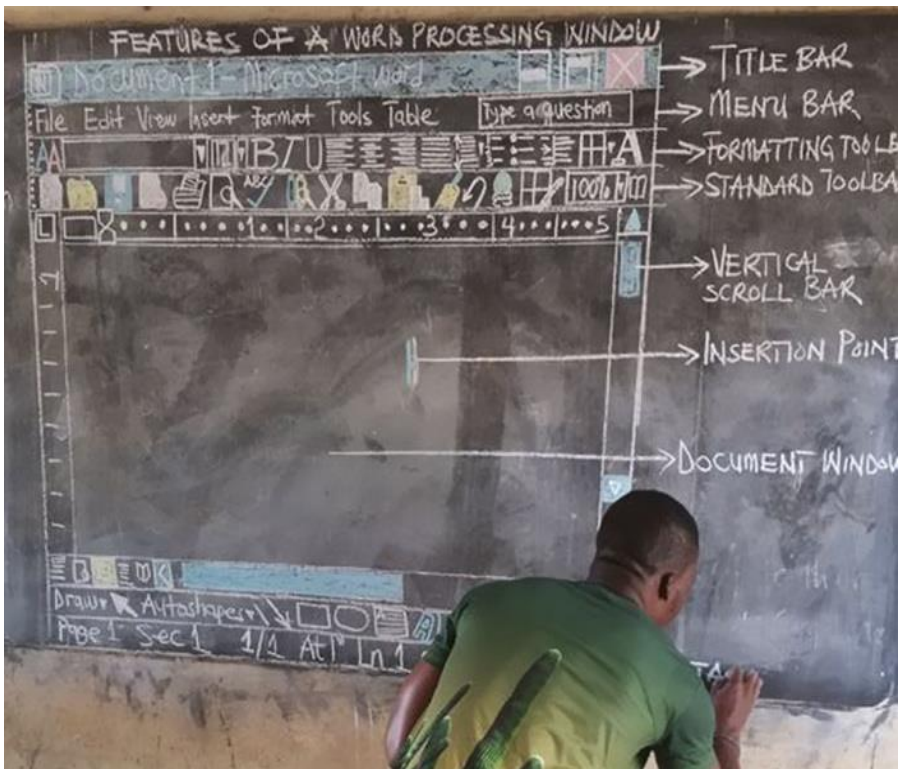
Type of barrier	Barrier	Details
Facilities	Access to electricity	Most ICTs require access to electricity either for charging or for use. Many schools, especially in rural areas, are not connected to the electricity grid and, when they are, they do not always have access to quality electricity[22] (that does not damage equipment) all day long. Few schools have access to alternatives such as off-grid electricity, although this is developing and could be an interesting solution (see Recommendations).
	Internet access	Some ICTs (especially the more advanced ones) require an internet connection. In most of the target countries, fixed internet is very poorly developed. Mobile internet is growing rapidly and much of the population in the target countries is now covered by 3G[23]. However, the cost of access to mobile internet remains a barrier for many schools. A number of ICTs can be used offline (without internet).
	Secure place for ICT storage	ICT equipment is expensive and keeping it in a school can be a source of insecurity (risk of break-in/theft). Schools using ICT should therefore have secure storage areas and reinforced doors/locks to ensure the safety of children and teachers.
Equipment	Lack of relevant and up-to-date hardware and software	Most schools do not have traditional ICT equipment (computers, tablets, printers, etc.) or basic software (office automation). As for accessible or specialised ICT (accessible computers, screen readers, Braille printers, etc.), it is almost non-existent in the classrooms of the target countries. Where schools have access to ICT, it is often outdated (especially software), so that many technologies that require more recent versions cannot be used. Some of the ICTs available in the schools of the target countries are donations, and sometimes they do not meet the needs of the schools.
	Lack of adequate furniture for computer equipment	The lack of furniture suitable for ICT use in general (e.g. a desk with space for a computer screen and keyboard) is also a barrier. The barrier is even greater for children with

[22] See table 'Potential barriers to the use of ICT in schools in the target countries of the study', page 17.
[23] Idem.

Type of barrier	Barrier	Details
		disabilities, who rarely have access to furniture suitable for ICT use.
	Little account is taken of the local characteristics of countries in the design of ICTs.	Most ICTs have been designed in developed countries and take very little account of the specificities of other countries such as language, accents, way of speaking, etc. The majority of ICTs are available in English, with only a few ones available in French; moreover, ICTs are rarely available in local languages, making them poorly adapted to the characteristics of the study countries.
Digital literacy	Lack of digital literacy among teachers and students	Most teachers and students in the target countries have had very little exposure to ICT and have limited digital skills. This is a major barrier to the use of ICT in the classroom.
Medical support	Lack of specialised staff to adapt and maximise the impact of ICT for children with disabilities	The lack of doctors to diagnose children with disabilities and their needs, and the lack of medical support staff (physiotherapists, occupational therapists, etc.) is a major barrier. Health professionals play a key role in identifying the most appropriate ICTs for the child and adapting the ICTs and the child's home and school environment for the best impact.
Consensus/clear understanding of the use of ICT for inclusive education	Lack of consensus on the appropriateness of using ICTs exclusively for children with disabilities in inclusive classrooms	There is no clear consensus among stakeholders on the appropriateness of using ICTs for children with disabilities exclusively in an inclusive classroom. Some consider that ICTs are assistive technologies and think that it is entirely justified to make them available only to children with disabilities in a context of scarce financial resources. Others, however, believe that providing ICTs only to children with disabilities goes against the principles of equity among children. Indeed, digital skills are essential for the inclusion of all children in an increasingly digital society. This lack of consensus on how to reconcile ICT and inclusive education in an ethical way when programmes have limited budgets is an obstacle to the digitisation of inclusive schools.
	Isolating children with disabilities in the classroom for the use of certain ICTs is contrary to the principles of inclusive education.	Indeed, some ICTs tend to isolate the children with disabilities who use them. For example, the Annie Braille learning machine speaks words that are displayed in Braille on the device. This forces the child to isolate himself from the rest of the class to do his exercises. Similarly, a screen reader requires the child to use headphones, which tends to isolate the child from the rest of the class. Further research on how to use ICT appropriately in an inclusive education context and a consensus among professionals is necessary to guide the development of programmes on ICT use in inclusive schools.
Clear understanding of the lending and	No memorandum of understanding on the roles and responsibilities of each	When ICTs are made available to schools, many actors are generally involved, such as the Ministry of Education, regional authorities, NGOs, maintenance technicians,

Type of barrier	Barrier	Details
maintenance of ICTs in inclusive schools	stakeholder in the use and maintenance of ICTs.	teachers, students, parents, etc. Some pilot programmes[24] have noted the absence of a clear memorandum of understanding between the various partners defining their roles and responsibilities (who owns the ICT, who installs it, who may use it, under which conditions, who is responsible for repairing/maintaining it, how often, under which conditions, etc.). This can jeopardise the programme because some ICTs can be quickly damaged and taken out of service due to lack of maintenance.
	Lack of ICT maintenance skills	In the target countries of the study, technical skills are scarce. However, some ICTs are very complex and require in-depth knowledge to set up, maintain, repair, update, etc. It is therefore essential to take a better account of locally available technical skills when choosing the ICTs to use.
Lack of commitment, resources and strategy/vision for ICT and inclusive education at government level	Lack of statistics to assess ICT needs in inclusive education and develop a national strategy	In many countries, the lack of reliable statistics on the number of children with disabilities in and out of school makes it difficult to assess needs – in terms of ICT, but also more generally – and to define a national strategy for ICT and inclusive education.
	Lack of will in some ministries to include ICT and inclusive education in national education strategies	In some countries, there is a lack of will to include the use of ICT for inclusive education in national education strategies at the ministry level. Yet, this is essential for the development of programmes. When ICT and inclusive education are integrated into the national education strategy, there is often a lack of operational documents that show how to implement these policies on the ground can be used as a guide by teachers, school directors, educators, etc.
	Lack of coordination of ICT and inclusive education initiatives at national level	In most countries, there is no national structure/platform dedicated to inclusive education and ICT. Yet, such platforms are necessary not only to coordinate the different initiatives, but also to exchange best practices and develop a clear national strategy.
	Lack of financial resources	The lack of financial means is a major barrier to the use of ICT, which is usually quite expensive. In addition to the lack of ICTs, there is also a gap in terms of quality, with countries tending to resort to donations (salvaging ICTs that are not always fit for purpose) or to purchase low-quality ICTs that are not always suited to their needs. The lack of resources also poses a problem when it comes to the maintenance of the ICTs in order to ensure the sustainability of the programmes.

[24] See Morgado Ramirez, Dafne, Holloway, Catherine and Austin, Victoria, *Report on the Usability of Assistive Technology in Ugandan Schools with Children with Visual and/or Hearing Disabilities. A report from the Global Disability Innovation Hub for UNICEF,* May 2019.



In Ghana, a computer teacher draws Microsoft Word on his blackboard because he has no computers to teach his students.
Photo credit: Facebook account of teacher Owura Kwadwo (CNN)

The case study below presents the results of an **assessment of a pilot project in Uganda on the use of ICT for inclusive education**. It illustrates **many of the barriers** that were identified in this study regarding the **use of ICT in inclusive classrooms**.

Case study – Uganda – Assessment of a pilot project on the use of ICT to support inclusive education[25]

UNICEF, in partnership with Uganda's Ministry of Education and Sports (MOES), has launched a pilot project to use ICTs to support inclusive education. The project aimed to **develop accessible learning material** for visually impaired/blind and hearing impaired/deaf children and to **provide equipment** (computers, projectors, speakers, screen readers, etc.) **for using this material** in classrooms. Solar panels were also provided to schools that were not connected to the electricity grid. The pilot project also included a **training component** to teach teachers how to use these technologies. The results of the assessment are as follows:

Benefits:

- **Schools and teachers showed strong interest** in the programme.
- **Benefits of accessible learning materials**, not only for children with disabilities, but also for the other students

[25] Source for this case study: Morgado Ramirez, Dafne, Holloway, Catherine and Austin, Victoria, *Report on the Usability of Assistive Technology in Ugandan Schools with Children with Visual and/or Hearing Disabilities. A report from the Global Disability Innovation Hub for UNICEF,* May 2019.

- **Improved awareness of disability among all students in the classroom** - In some classrooms, all students learn sign language with the accessible materials, thus promoting the inclusion of hearing impaired and deaf students.
- **Students quickly learn to use the technologies and find them useful.**

Challenges:

- **The quality of the hardware and software was not adequate** (the operating system of the computers was too slow, resulting in the audio, image and sign language being out of sync in some videos, the video projectors heated up quickly, the speakers were not loud enough for large classrooms in rural areas, etc.). All this had a significant impact on the usability of the material for teachers and children. In addition, the **computers were running on an operating system that was not widely used** (Ubuntu) and **many teachers, including those who were computer literate, were not familiar with it** because they had been trained on the Windows operating system. This is partly due to the procurement model chosen for the project: **materials were largely donated, rather than chosen to fit the specific needs of the project**.
- Often, in crowded classrooms (~53 students per class in rural Uganda), children **did not have enough space on their desks for a computer and a book or copybook**, making ICT use more difficult and uncomfortable.
- **Many teachers lacked digital skills** and had difficulties in using the ICTs, despite the training they had received.
- **Technical support was inadequate**:
    - **Teachers had not been sufficiently trained to carry out basic adjustments and small repairs.** *Example: The computers were delivered with the power saving mode turned on. They entered sleep mode very quickly, which obliged students to log back in regularly, resulting in wasted time.*
    - **Teachers did not know when to contact technical support** (when they had a question, when the equipment started to malfunction, when the equipment was completely out of order, etc.) and what they could expect in terms of support (a visit to the school to repair the equipment, instructions given by phone for the teacher to repair it themselves, time needed to repair the equipment, etc.).
    - **Maintenance was provided by a university based in Kampala.** This made repairs difficult and time-consuming because technicians had to travel from Kampala to the schools when a problem occurred.
    - **There was no provision for equipment replacement** during the repair period. This left schools without equipment for many weeks.
    - **No preventive maintenance plan had been put in place.** Technical support was requested when the equipment was already out of order.
- **There was no mechanism in place for exchange of experience between pilot schools.** This would have allowed teachers to share their experiences and would have reinforced their motivation to use these new tools. To address this issue, some of the teachers decided to start a WhatsApp group during the project for information exchange.
- **Local authorities were not sufficiently informed about their role** in the project and did not know what was expected of them.

Mitigation plan and recommendations

During the study, a number of **barriers to the use of ICT in inclusive schools** were identified. This section explores **ways to address these challenges** and makes **recommendations** for promoting the use of ICT in inclusive education in the countries of the study. However, **further research is needed** to assist in the design of an ICT and inclusive education programme for the target countries of the study.

Note: many other elements not specific to the use of ICT should also be taken into account for the success of such programmes and are not mentioned here (e.g. training of teachers in inclusive education, raising parents' awareness of the importance of education for their children with disabilities, etc.)

Access to electricity

Access to electricity is a prerequisite for the use of most ICTs (at least for recharging). Few schools are connected to the electricity grid, but **off-grid alternatives** can be considered. Many private companies (Qotto, BBOXX, Oolu, ARESS, etc.) offer solar power solutions in the target countries of the study. These solutions consist in installing solar panels on the building to be electrified, and the user pays monthly fees via mobile money (a solution to the headache of collecting payments). **These solutions are already used by over 100 million people worldwide**[26] and should be considered for ICT programmes in off-grid schools.

There are also initiatives to set up **small, comprehensive and low-cost computer labs that run on solar power**.

SolarLab in Sierra Leone (computer lab)

SolarLab (https://solarlearninglabs.org/) for example, has a partnership with DELL and uses containers equipped with computers. 21 laboratories have so far been built in six countries, including Sierra Leone, Ethiopia and South Africa.

A lot of advocacy work is needed to **convince governments of the need to provide access to electricity to schools**, as this is an essential prerequisite for large-scale ICT deployment.

[26] GOGLA, *Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data*, 2020.

Internet access or offline technologies

Some ICTs require internet access, which few schools have. Although fixed internet is not well developed in Africa, **mobile internet** is increasingly used and **3G coverage is expanding rapidly**. Solutions such as **mobile WiFi** allow for easy internet access and can be used in schools to make internet available in classrooms. However, a **budget is needed to finance this internet access**.

Malitel mobile WiFi advert in Mali

EDbox nano server in Burkina Faso

An alternative is to turn to **ICTs that do not require an internet connection**, and use **nano-servers to access digital content offline**, for instance**.** Solutions such as Kekelithèque in Togo (presented in section 6.3 Examples of initiatives to use ICT for school inclusion) or EDbox in Burkina Faso (below) allow computers/tablets/smartphones to be connected to digital content on local storage, without internet access.

ICT and inclusive education programmes must be developed in a coherent way to ensure that **everything that is required to access educational content is provided by the programme** (or is already available in the schools).

Relevant quality equipment (hardware and software)

Most **ICTs and accessible educational content/activities** are based on technologies such as video or audio which have **minimum power and speed requirements for perfect playback** (without clipping, without video and audio going out of sync, etc.). **High quality, fast and efficient equipment** is therefore necessary. Such equipment is usually recent and is **the most expensive**. However, they are also **the most likely to incorporate accessibility features** and usually do not require the purchase of additional accessibility software. A thorough needs analysis is therefore necessary to determine the type of equipment best suited to the objectives and context of the project. Although this may require **additional funds**, it is advisable **not to neglect the quality of the ICT provided**, which seems essential to project success.

Digital literacy for teachers and children

In many countries, **teacher training programmes do not include a specific module on the use of ICT**. Many teachers do not have ICT equipment at home and therefore have a poor command of these tools. For teachers who have digital skills, the ICT provided may not work with the type of computer, operating system, software, etc. that they have been trained on. For these reasons, **extensive teacher training is essential for any ICT and inclusive education programme**. Teachers will be on the front line and will be required to use the tools themselves and assist the children using them in the classroom. Training should be provided for **all teachers** who may be required to teach children with disabilities. It should include **training on how to use the ICTs, but also on basic ICT configuration and maintenance** (e.g. how to change the contrast, how long before the device goes into standby, how to update, etc.) so as not to overburden the technical support team.

Children also need to be trained in the use of the ICTs before they are introduced in class. This training can be done by the teachers (if they are well trained and have the required skills) or by an external partner. The aim of the training should be to give children a certain level of autonomy in the use of ICTs the classroom.

Medical support to adapt the ICTs and maximise their impact on the educational inclusion of children with disabilities

Health professionals are invaluable in adapting ICTs to children's difficulties in order to maximise their impact on school inclusion. They can help identify children who need ICT to study, define the most appropriate type of ICT according to their difficulties, define the best parameters for the optimal use of the ICT by the child, etc. In many countries, **these health professionals** (doctors, physiotherapists, occupational therapists, etc.) **are few in number**. However, ICT, whose primary function is communication, can help to **connect teachers/parents/community workers with these professionals for videoconference consultations**, for example. While face-to-face consultation in the classroom is obviously the preferred solution, distance consultation is an interesting alternative to provide **support to inclusive education actors in remote areas** and help them adapt the classroom, the ICTs, the educational content/activities, etc. to suit the children's needs. Telemedicine, which uses distance consultation, is increasingly expanding in low- and middle-income countries.

Pakistan – Using ICT to given women in remote areas access health services

Pakistani women have very limited access to health services, particularly in rural areas. One reason is that social norms often **prevent women from consulting male doctors**. However, while women represent a significant number of medical graduates in Pakistan, **only 23% of these women doctors practise medicine**. This phenomenon known as 'bride doctor' is due to social norms that encourage many female doctors to stay at home and take care of children once they are married. Sehat Kehani, a startup founded by two Pakistani doctors, **uses ICT to combat this phenomenon and provide Pakistani women with access to health care**. **Community workers receive patients** in the

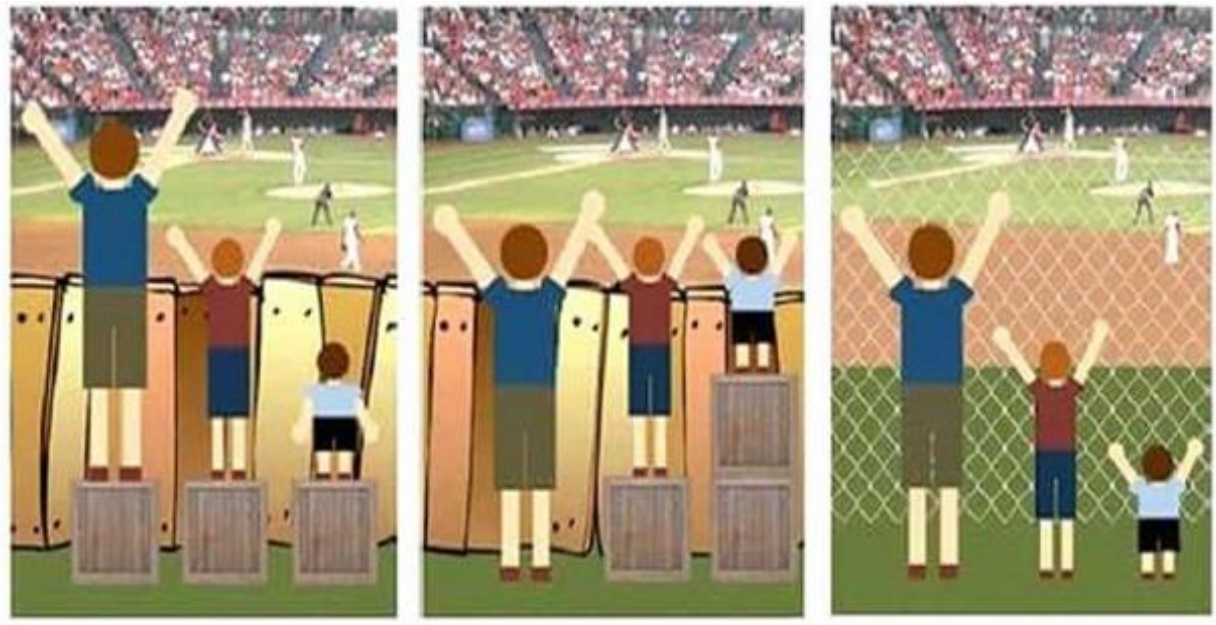
community. **Then, they use videoconferencing to connect with female doctors** who consult from home. **The community workers perform basic procedures** (taking blood pressure, listening to the heartbeat, etc.) on the instructions of the doctor, and the doctor makes the prescription. **Thus, ICT makes it possible to connect women in remote areas with doctors who cannot easily travel to see them.** *Sehat Kehani also offers other services, such as medical consultations for individuals via an app, mental health consultations, etc.*

For more information: https://sehatkahani.com/

Organisation of general assemblies with partners to define best practices for the use of ICT in inclusive schools

Before launching an ICT and inclusive education programme, it seems necessary to **organise general assemblies with the various partners** (Ministry of Education, school representatives, NGOs, international organisations involved, etc.) in order to **jointly define best practices for the use of ICT in inclusive schools**. The study showed that there are **differing views on how ICT should be used in inclusive schools**. The issue of equity between children (with and without disabilities) and the isolation that some ICTs can cause are particularly debated. Organising general assemblies, if possible with the participation of specialists, would be an opportunity to **discuss existing studies and reach a consensus**, the aim being to **launch pilot ICT and inclusive education programmes that have the support of all partners concerned**.

ICT and inclusive education programmes should aim at being 'inclusive transformative', which means removing barriers to inclusion, not just 'inclusion sensitive', i.e. supporting individual needs but not removing barriers. Both of these models are in contrast to the 'inclusion blind' approach, where everyone is treated the same, regardless of their specific needs.



Inclusion blind **Inclusion sensitive** **Inclusion transformative**

Clear definition of the roles and responsibilities of each project partner, including for ICT maintenance

When defining an ICT and inclusive education programme, a **clear protocol detailing the roles and responsibilities of the different project partners**, including those in charge of ICT maintenance, is essential. The protocol should determine who owns the ICT, who is responsible for installing it, where it will be stored, who can use it, under which conditions, who will be responsible for maintenance, how often, etc. This should **ensure the sustainability of the programme** even in case of an ICT breakdown. A choice will have to be made between a **centralised system** (at national, regional level, etc.) where schools request the appropriate ICT at the beginning of the year according to the profile of the students they receive and maintenance is ensured by technicians at the central level, and a **more decentralised model**. In the latter case, each school has its own ICT and technicians are present locally to provide rapid technical support.

The choice of the model will require further study and will also depend on the context (budget, number of ICTs available, skills of local technicians, etc.). The pilot programmes examined in the study seemed to favour a decentralised model with a 'resource centre' within the schools from which ICTs are borrowed when needed. However, maintenance was not always carried out locally, often due to a lack of technical skills.

Integration of ICT for inclusive education into countries' national education strategies and working closely with the ministries of education for the development and implementation of programmes

Since education is state-run, **the involvement of the Ministry of Education in ICT and inclusive education programmes is crucial** to their success. The first step is therefore to **convince governments of the potential of ICT for inclusive education and to encourage them to integrate this component into their national education strategies**. **Statistics** on children with disabilities should also be collected in order to assess the ICT needs of schools throughout the country and set up **platforms at national level to coordinate the different ICT and inclusive education initiatives** and exchange best practices. **Specific budgets** should also be allocated to equip schools with ICT and enable the implementation of national education strategies that are ICT-inclusive.

The strategies should also take into account all the elements in this section that are needed for the implementation of ICT in schools, including solutions for access to electricity and the internet, teacher training, defining a model for ICT maintenance in schools, etc.

Advocacy with major tech players to encourage them to commit to the use of ICT for inclusive education in target countries

Global tech players (computer/tablet/phone manufacturers, software developers, mobile operators, technology service companies such as Google, etc.) are **increasingly aware of the need to make their products and services accessible**. Disability stakeholders have a role to play in **continuing to mobilise**

them and ensuring that these accessible products and services are available to as many people as possible, particularly in developing countries. This requires an awareness of local **specificities** (languages, accents, ways of speaking, conditions of use such as heat or humidity, etc.). Some actors could also be **approached to support ICT and inclusive education programmes**. For example, DELL is the technology partner of SolarLab (a solar computer lab – see above), Microsoft has funded many initiatives to train children in the use of ICT (including children with disabilities), and Orange has recently signed the GSMA's Principles for Driving the Digital Inclusion of Persons with Disabilities[27].

[27] For more information on these principles: https://www.gsma.com/mobilefordevelopment/principles-for-driving-the-digital-inclusion-of-people-with-disabilities/

Annexes

1. Detailed study methodology

1.1. Overview

The study has **two phases**:

- **The first phase consisted in data collection through secondary research and interviews with experts and potential ICT users** (students with disabilities, parents, teachers). The objective of this phase was to collect information on existing ICTs, their usefulness, limitations, requirements, etc., to serve as a basis for reflection during the analysis phase.
- **The second phase was the data processing and analysis** with the aim of compiling the ICT Directory for Inclusive Education. For each of the ICTs identified, a technical, practical and logistical analysis has been carried out, and recommendations were made regarding the appropriateness of using the technology in HI programmes in Francophone Africa (taking into account the usefulness of the ICT, its cost, its ease of use, its impact on school inclusion, etc.). The main challenges to the implementation of ICT and inclusive education programmes were also identified and recommendations were made.

1.2 Interviews with international experts

12 interviews with international experts were conducted:

#	Subcategory	Name	Country	Organisation
1	Mobile industry	Clara Aranda-Jan	United Kingdom	GSMA Assistive Tech
2	Academic/researcher	Giulia Barbareschi	United Kingdom	GDI (Global Disability Innovation) Hub
3	Government and DPOs/NGOs	Soraya Company	France	APACT (Association pour la Promotion de l'Accessibilité et la Conception pour tous)
4	International organisation	Richard Daretry and Noemi Robiati	Madagascar	UNICEF[28]
5	Tech/digital players	Bouayom Djimadoum	Chad	Label 109
6	Incubators/startups	Samy Lounes	France	Comptoir des Solutions

[28]This interview was conducted with one person based in Madagascar and another based in Denmark, and both had international experience regarding UNICEF education projects. During the interview, the discussion focused on the use of ICT for education in general in different countries of the world, and more specifically in Madagascar.

7	DPO/NGO	Guillaume Madiona	France	ICOM
8	International organisation	Mahama Ouedraogo	Ethiopia	African Union
9	Academic/researcher	Dafne Ramirez	United Kingdom	University College London – Interaction Centre
10	Tech/digital players	Debra Ruh	United States	Ruh Global
11	Tech/digital players	Lamine Sarr	Senegal	Nouvelles Éditions Numériques Africaines
12	Government and DPOs/NGOs	Jean-Marie Schléret	France	National Observatory for Safety and Accessibility of Educational Institutions

Note: Some of the international experts were based in the target countries of the study. They were usually bi-nationals working in an international organisation or in several countries. The interview focused on their general expertise in ICT, education and disability, but not on the country context. They were therefore considered as international experts.

1.3 Interviews with experts in the countries of intervention

12 interviews with experts in the countries of intervention were conducted:

#	Subcategory	Name	Country	Organisation
1	DPO/NGO	Marc Analene	Togo	Fédération Togolaise des Associations de Personnes Handicapées
2	DPO/NGO	Joseph Birba	Burkina Faso	Association burkinabé pour l'orthophonie
3	Government	Mohammed Anouar Boukili	Morocco	Central Ministry
4	Mobile industry	Abdelaziz Ezzouhri	Morocco	Maroc Telecom
5	Government	Sidibe Fatou	Niger	Ministry of Education
6	DPO/NGO	Robert Gbengbernabe	Togo	SEFRAH (Service de Formation et de Réhabilitation des Aveugles et autres Handicapés)
7	DPO/NGO	Elie Kamate	Mali	Sightsavers

8	Tech/digital players	Nabil El Maaroufi	Morocco	Accessibility Project Manager in a large multinational company (confidential)
9	DPO/NGO	Bakouan Mamourou	Burkina Faso	Association des amis des jeunes sourds et malentendants du Soum
10	DPO/NGO	Ndior Mansour	Senegal	INEFJA (Institut national d'Éducation et de Formation des Jeunes Aveugles)
11	DPO/NGO	Dodzi N'Kekpo	Togo	Fédération Togolaise des Associations de Personnes Handicapées
12	Government	Hamidou Ouedraogo	Burkina Faso	Directorate for the Protection of Persons with Disabilities

1.4 User interviews

14 interviews with potential ICT users (students with disabilities, parents of students with disabilities, teachers of students with disabilities) **were conducted**, as follows:

	Students with disabilities	Parents	Teachers
Benin	1	1	2
Niger	1	1	2
Senegal	2	2	2
TOTAL	4	4	6

The interviews covered **visual, hearing and motor disabilities, as well as DYS disorders**[29]. They were conducted around the following schools:

- **Benin**: École des Sourds de Louho
- **Niger**: École Yantala 1
- **Senegal:** École Pikine 23B and INEFJA

[29] DYS disorders or specific cognitive disorders include dyslexia, dysorthographia, dyspraxia, dyscalculia or dysphasia. Attention disorders and memory impairment are also usually associated with DYS disorders.

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Information and Communication Technologies (ICTs) and Inclusive Education

Children with disabilities are among the **most excluded** learners in the **education system**. The exponential development of ICTs (Information and Communication Technologies) throughout the world provides a real opportunity to improve the educational inclusion of these children.

This study, which was carried out within regional inclusive education projects implemented by Humanity & Inclusion, aimed to:

- Identify existing ICTs that can support the educational inclusion of children with disabilities
- Identify the challenges to the implementation of these ICTs in the classroom in some of Handicap International's French-speaking countries of intervention, namely Benin, Burkina Faso, Madagascar, Mali, Morocco, Niger, Senegal and Togo.

This report is accompanied by an, ICT Directory for Inclusive Education | Source (asksource.info) which presents all the ICTs identified during the study.

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