

USER REQUIREMENTS DOCUMENT FOR ACCESSIBLE DIGITAL TEXTBOOKS

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Introduction

No printed book can offer all the necessary features to ensure access to all users. Amongst the ones most excluded from reading and learning are children with disabilities. Technology can reduce and eventually close this divide. Through digital formats, books can be made accessible to students who are: blind or have low vision, deaf or hard of hearing, have intellectual/developmental disabilities, learning disabilities, and motor disabilities among others. Accessible formats are versatile and users can customize and combine different features like audio, text, sign languages, font type and size, background contrast, line spacing, illustrations and other functions to suit different access needs or preferences. “The Digital Textbooks for All” initiative aims to give students with visual, hearing, intellectual, motor, developmental and learning disabilities equal access to digital textbooks and learning. In this initiative, the concept of Universal Design is meant to be applied to the design of the technology as well as of the pedagogic content of the book.



To achieve Sustainable Development Goal (SDG) 4 by 2030 and include children with visual, hearing, learning, motor, intellectual and developmental disabilities in education, UNICEF and partners are developing an innovative digital solution that aims to make textbooks accessible and improve learning outcomes for ALL children. As part of this innovation, guidelines for publishers, authors, and teachers are being developed to provide Ministries of Education in low- and middle-income countries guidance on how to develop accessible digital textbooks and learning materials.

Purpose

This user requirements document (URD) specifies what the different types of users need from the technology perspective of the digital textbooks to make them accessible and to enhance users' learning experience, in equal conditions with their peer classmates. The digital textbook was intended for school aged children, teachers, parents or caretakers with or without specific technological knowledge/skills. The document is the product of various consultations with disability experts, educational technologists, special educators, and users around the world. Through a series of workshop, they have identified the most important functions and minimum requirements needed

to support accessible digital textbooks and reading materials for children with disabilities. The document is also informed by a literature review.

While the functionalities required in the technology to accommodate a specific type of user is listed under one disability area, it was observed that often, several functions serve equally to different types of disabilities. These observations stimulate us to consider a Universal Design approach to the technology, always when it will not reduce function for any specific type of user. The utilisation of the digital textbooks can happen in different scenarios: (1) inclusive classrooms; (2) regular classrooms; (3) learners with different types of disabilities in home schooling situation; (4) learners with different types of disabilities doing homework or studying at home/with parents with/without disabilities; (5) learners without impairments doing homework or studying at home/with parents with disabilities; (6) children with different types of disabilities who are out-of-school.

Background

In most low and middle-income countries, access to textbooks is limited and where textbooks do exist, the associated costs can be prohibitively expensive for most schools. For example, a 2015 study by the United Nations Educational, Science and Cultural Organization (UNESCO) showed that most primary school students in Africa are required to share textbooks (UNESCO, 2015). For students with disabilities this gap in access to textbook is even more profound due to additional barriers and discriminatory views related students with disabilities and the misperception that they are not able to learn. For example, the World Blind Union (WBU) estimates that less than 10% of all published materials can be read by individuals who are blind or have low vision (WBU, 2017). When textbooks do exist, they are often not adopted or modified to ensure that they are accessible to students with disabilities. Most special education teachers and general educators lack the knowledge and skills needed to appropriately modify textbooks or curriculum for students with intellectual disabilities or severe learning disabilities (UNESCO, 2004). In order for countries to comply with Article 24 of the United Nations Convention on the Rights of Persons with Disabilities (UN CRPD) and to obtain Goal 4 of the Sustainable Development Goals (SDGs), the gap in accessible textbooks must be bridged in order to allow for students with disabilities to reach their full academic potential.

Research shows that print materials tend to be more costly than digital textbooks (Global Book Fund, 2016). Because of this, many ministries of education, schools and organizations are looking to invest in digital textbooks in the future. This would allow for multiple low-cost textbooks to be accessible through a single tablet. Furthermore, through digital formats, books can be made accessible to readers with a variety of categories of disabilities. Accessible formats are versatile and users can customize and combine different features like audio, text, sign language, font type and size, background contrast, line spacing, illustrations and other functions to suit different access needs or preferences. This concept of accessible textbooks follows the basic principles of UDL, which signifies the design of products, environments, programs and services that can be used by all people, to the greatest extent possible, without the need of adaptation or specialized design. A textbook developed under “universal design for learning” principles will have more features that are more

effective for more people in more situations. It enhances utilization and learning for children and adults with and without disabilities and may facilitate them to study together.

Accessible digital textbooks

All the functionalities that are available in the software will be independent but synchronized. This means that the user would be able to create a profile with his preferences and when the book is uploaded in the software, the settings are automatically installed. This way, no presumptions on what are the needs for a specific type of disabilities are made, but rather offering the user to choose what is best for him to learn. This will facilitate the learnings especially in a context where the tablet or other digital support is shared within students in the classroom. Although, default settings for some disabilities are suggested to help the teachers/parents/users who are not familiar with the functionalities that can help a certain type of disability.

This document is divided in five sections, which are the same as the default settings suggested in the software: 1) Blind and low vision; 2) Deaf and hard of hearing; 3) Intellectual and developmental disabilities; 4) Learning disabilities; and 5) Motor disabilities. Each section will present a brief information on the type of disability and their accommodation needs. The Matrix provides suggested functionalities by disability that could be incorporated into accessible digital textbooks.

In this matrix, the minimum requirements for the digital textbook to be create in the first phase of the project are proposed and more suitable for countries of low and middle income. Furthermore, more complex features for future phases that could also be used for countries with more resources are also listed. The objective is to list all the preferred functionalities for accessible, digital textbooks that will facilitate textbook use by all children with disabilities, considering the variability in technical, logistical, political, functional, geographical, and human resources.



Functionalities by disability

- **Accommodations for Students Who are Blind or Have Low Vision:**
Although there is not a common definition for blindness, it is often referred to as

someone who has visual acuity of not greater than 20/200 even with glasses or correctional support. For low vision, this is usually referred to someone who has functional vision but has challenges viewing objects either nearby or far away even with glasses or correctional support (Jernigan, 2005). While some individuals are born with blindness or low vision, other acquire the disability as they age. Many students in low and middle-income countries with low vision are not identified as many countries do not perform routine vision screenings. As a result, they are often do not receive the accommodations they need to read. For students who are blind accessing text often signifies having access to materials in braille. For other students with vision related challenges, they may benefit from accessing audio books as well as having text in large print (i.e. font size of 18 points or larger). The below items contribute to the accessibility of the digital textbooks for students who are blind/low vision.

- **Accommodations for Students Who are Deaf/Hard of Hearing:** Similar to blindness/low vision, there is no universally recognized definition for deaf or hard of hearing. The term deaf usually refers to an individual with very little to no functional hearing while hard of hearing is used for individuals who have mild-to moderate hearing loss (Deaf TEC, 2017). Students who are deaf or hard of hearing should have access instruction using bilingual education, which educates students in both the local, indigenous sign language and the national written language. However, in many low- and middle income countries, students who are deaf or hard of hearing do not have access to neither sign language nor are they taught literacy skills. It is estimated that only 1%–2% of people who are deaf receive education in sign language (World Federation of the Deaf, 2007). Furthermore, only 80% of students who are deaf attend school worldwide (World Federation of the Deaf, 2007) and many graduate without obtaining the vital literacy skills they need to obtain gainful employment.
- **Accommodations for Student with Intellectual and/or Developmental Disabilities:** An intellectual disability, also referred to as a cognitive disability, signifies having “significant limitations both in intellectual functioning (reasoning, learning, problem solving) and in adaptive behaviour, which covers a range of everyday social and practical skills.” (American Association on Intellectual and Developmental Disabilities, 2010). Developmental disability is a broader term that signifies an impairment in physical, learning, language or behaviour areas. Examples of developmental disabilities include autism, cerebral palsy, Down syndrome or spina bifida. It is important to note that while some individuals with developmental disabilities may also have an intellectual disability, other individuals may have average or above average intelligence. Given the large spectrum of educational needs represented within this group, supports should be as individualized as possible. Examples of accommodations that a student with an intellectual or developmental disability may have include simplified text, text supported with symbols or pictures, augmentative and alternative communication (AAC) and text to speech software. The below items contribute to the accessibility of the digital textbooks for intellectual, developmental and learning disabilities students.

- **Accommodations for Students with Learning Disabilities:** Learning disabilities, considered to be a high incidence disability, can be defined as “a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations.” (IDEA, 2004). It is estimated that approximately 15-20% of students may have some form of learning disabilities. It is suspected that there are large numbers of students, particularly in low- and middle-income countries, that are undiagnosed and thus are not receiving appropriate supports and services related to their learning disability (Cortiella & Horowitz, 2014). Learning disabilities can include: Auditory Processing Disorders, Dyscalculia, Dysgraphia, Dyslexia, Language Processing Disorder, Non-Verbal Learning Disabilities and Visual Perceptual/Visual Motor Deficit. Students with some form of learning disabilities may benefit from simplified text, audio versions of the written text, spell check features, and access to calculators (Hodge, 2000). The below items contribute to the accessibility of the digital textbooks for children with different types of learning disabilities.
- **Accommodations for Students with Motor and/or Physical Disabilities:** A motor or physical disability can partially or fully impair the function of a body part. This can result from certain neurological conditions as well as through a spinal cord injury. Some students with motor or physical disabilities may have challenges turning pages of traditional print textbooks without support while other individuals may need supports manoeuvring tablet based textbooks. The below items contribute to the accessibility of the digital textbooks for children with motor disabilities.

User Requirements Matrix - Functionalities by Specific Disability-

The Matrix is a comprehensive list of the functionalities proposed to accommodate the needs of all children with different type of disabilities for learning with digital textbooks. These functionalities categorized by priority:

- **Mandatory requirement:** This represents a functionality that **must** be available in the software.
- **Preferred requirement:** This represents an important functionality that **should** be available in the software.
- **Possible future enhancement:** This represents functionalities that are planned for **future** phases of the technology development.

The intention is to help design a prototype that can serve as model for others as they look to develop accessible tablet-based textbooks and reading materials. This matrix helps to demonstrate that a single functionality often supports a variety of types of learning disabilities. For example, having the ability to select and maintain screen orientation is a benefit for all disabilities as it avoids confusion and disorientation. Likewise, having subtitles for videos is beneficial for students who are

deaf/hard of hearing, have intellectual disabilities, and for some students with learning disabilities. Other functionalities presented on the matrix, such as video with a synchronized sign language interpreter in local sign language, is design specifically for one category of disability.

Having the functionalities categorized by priority is intended to help guide the basic functions that need to be a part of all accessible textbooks while also providing additional aspirational options for the future.

DRAFT

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