Assistive technology

for learners who are blind or have low vision

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A TEDI short guide

TEACHER
EMPOWERMENT
FOR DISABILITY
INCLUSION

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Foreword

The Teacher Empowerment for Disability Inclusion (TEDI) project aims to empower teachers and carers to provide quality education for children with severe to profound sensory or intellectual impairments (SPSII) through training that is focused on inclusivity, diversity and addressing learners' disability specific needs.

In 2018, TEDI piloted its first professional development courses and workshops for carers, teachers and other facilitators of learners who are blind or have low vision. Through these initiatives it became clear that there is a great need for the development of useful and practical resources for participants to enrich and further their learning on inclusive education. This short guide is one example of a response to this need.

This short guide is aimed at teachers and facilitators working and interacting with learners who are blind or have low vision. It responds to the need for these practitioners to understand more about assistive technology (AT), enable them to identify the need for technology, and assist with the selection of appropriate devices. Guidelines are provided on how technology can be used to support teaching and learning across the curriculum. This short guide adopts a practical, skills-based approach and is aligned with the Department of Basic Education's policy framework and learning programmes.

The purpose of this short guide is to:

› Provide basic knowledge on AT devices for learners who are blind or have low vision.
› Highlight things to consider when teachers and facilitators select and use AT for learners who are blind or have low vision.
› Enhance teachers' and facilitators' knowledge on AT for learners who are blind or have low vision.
› Illustrate how learners who are blind or have low vision can engage with the national school curriculum aided by appropriate AT devices.

› Supplement readers' learning through accredited, short online and contact courses on inclusive education by providing additional information on suitable AT for learners who are blind or have low vision.

› Promote a collaborative approach to teaching and caring for learners who are blind or have low vision.

This short guide can be read in conjunction with the free online course 'Teaching Children with Visual Impairment: Creating Empowering Classrooms' available through Coursera: https://www.coursera.org/learn/teach-children-with-visual-impairment

Acronyms

AT   Assistive Technology

CAPS Curriculum and Assessment Policy Statement

DBE   Department of Basic Education

FET   Further Education and Training (Grades 10–12)

FP   Foundation Phase (Grades 1–3)

ICT   Information and Communication Technology

IP   Intermediate Phase (Grades 4–6)

LTSM Learning and Teaching Support Materials

NCS   National Curriculum Statement

SP   Senior Phase (Grades 7–9)

SPID   Severe to Profound Intellectual Disability

SPSII Severe to Profound Sensory and Intellectual Impairment

UDL   Universal Design for Learning

Section

1

SECTION 1

Defining assistive technology

In this introductory section, we define the term 'assistive technology' (AT) and look at things to consider when identifying the need for and forms of AT for learners who are blind or have low vision. We also look at the classification of AT devices from no-tech to high-tech, and how this classification affects their application and use.

After reading this section, you will be able to:

› Define the term 'assistive technology'.

› Understand the classification of AT devices from no-tech to high-tech.

› Give some examples of AT.

› Understand the need for matching AT devices carefully to individual learners.

› Identify some of the AT recommendations made by the Department of Basic Education (DBE).

1.1   Introduction

The recommendations and considerations presented in this short guide come from observations, findings and guidelines from multiple research efforts, projects and sources. The starting point for determining the AT needs of learners who are blind or have low vision derived from the prescribed learning activities in the DBE's National Curriculum Statement (NCS) for Foundation Phase (FP) (Grades 1–3). The FP Curriculum and Assessment Policy Statement (CAPS) comprises four subjects: Home Language, First Additional Language, Mathematics, and Life Skills (DBE, 2011a, b, c).

The FP is the initial stage of schooling in which foundations of knowledge and skills development are laid for future learning and potential academic success. During this stage, learners who are blind or have low vision need to be able to fully engage with the curriculum in order to maximise their learning potential. Identifying AT needs is vital for optimal learning and to enable learners to enter subsequent phases.

It is important to note that this short guide does not list all known technologies, and will need to be updated as needs and technologies change and develop. Rather, this short guide acts as a point of reference for teachers and carers to support teaching and learning using technology to enrich the experience of learners who are blind or have low vision.

1.2   What is AT?

Technology is about how we use different types of knowledge and tools to carry out a variety of practical functions. We use technology all the time, ranging from simple low-tech tools such as pencils to high-tech devices such as cell phones and computers. Technology is growing in sophistication all the time and reflected in its use in schools and their classrooms. It presents great opportunities for the enrichment of learning if there is the right match according to the needs of learners, the environment, the knowledge of the teacher and the tools available (Dalton, McKenzie, et al. 2012).

Assistive technology is a device, piece of equipment or system that helps bypass, work around or remove barriers to participating in the curriculum (Reading Rockets, n.d.). AT can be used to address specific barriers to learning by enabling the learner to capitalise on strengths and bypass, areas of difficulty.

1.2.1 Classification of AT devices

AT devices can be classified from no-tech to high tech according to the degree of mechanical and electronic parts they are made up of, other requirements such as a power source, and the knowledge and training the device user must have to optimise its assistance. It is always recommended that no-tech and low-tech solutions be considered before looking at mid-tech and high-tech options. Some experimentation may be required before the best learner-technology match is achieved.

Although no-tech or low-tech devices may save on costs, the main objective is to find the tools that offer learners full access to the school curriculum and ensure they are able to meaningfully engage in teaching and learning activities.

This short guide does not focus on no-tech or low-tech solutions, but acknowledges that they can help learners with disabilities gain access to the curriculum. Rather, we look more closely at the mid-tech and high-tech solutions available to learners and their teachers.

Table 1: Classification of AT devices

Type	Description
No-tech	No-tech solutions make use of procedures, services and existing conditions in the environment, and do not involve the use of special devices or equipment. Examples include pencil grips; coloured paper; extra time for testing; and the use of a scribe, reader or interpreter (Roy, 2003; Weiland, 2003, cited in Martinez-Marrero and Estrada-Hernandez, 2008).
Low-tech	Low-tech devices are simple devices that have few mechanical parts and do not require a power source. They include adapted spoon handles, adapted pens, canes, non-tipping drinking cups, magnifying glasses, and eyeglasses. Limited or less training is needed to use these devices compared to mid-tech and high-tech devices.
Mid-tech	Mid-tech devices are relatively complicated mechanical devices that may require a power source, but do not contain sophisticated electronic systems. These devices include manual wheelchairs, talking calculators, adapted keyboards, and trackballs. The operation of mid-tech devices requires some training and technical knowledge.
High-tech	High-tech devices are often computer-based systems that incorporate sophisticated electronics. They are complicated to use and require extensive training, technical knowledge, and access to technical support. With their sophisticated electronics, high-tech devices are often much more expensive than other technologies. Examples include speech recognition software, eye gaze-controlled computers, closed captioning televisions, power wheelchairs, and environmental control units.

1.2.2 AT devices recommended by the DBE

The DBE's 'Draft National Guidelines for Resourcing an Inclusive Education System – Annexure A' (DBE, 2018) details, among other important aspects of inclusive education, examples of learning technologies recommended for learners with visual impairments. The standardised provision of AT to learners throughout South Africa would ensure they have access to appropriate

educationally enriching information and communication technology (ICT). Assistive technology devices that are suitable for learners with visual impairments are listed in the appendix to this short guide.

Section

2

SECTION 2

Selecting AT devices

In this section, we look at challenges to the effective use of AT devices by learners who are blind or have low vision, and their families and teachers. We outline some of the things to consider when selecting appropriate AT devices for learners who are blind or have low vision, and basic learning and teaching support materials (LTSM) requirements. The different categories of AT available for learners who are blind or have low vision are highlighted, as well as examples of mid-tech and high-tech devices.

After reading this section, you will be able to:

› Discuss some of the challenges facing teachers and learners in the effective use of AT

› List criteria to consider in the selection of suitable AT devices for learners who are blind or have low vision.

› Identify the different AT devices that can be used to assist learners who are blind.

› Identify the different AT devices that can be used to assist learners who are partially sighted

> ‣ Categorise AT devices for learners who are blind or have low vision according to their function.
>
> ‣ List examples of mid-and high-tech AT devices for learners who are blind or have low vision
>
> ‣ Describe some of the classroom resources that facilitate learning for learners who are blind or have low vision.

2.1   Challenges to the effective use of AT

Access to AT by children with disabilities, and their families, is a difficulty experienced worldwide. Equipment may be costly and there is a lack of funding for the provision of AT. Devices might be expensive and need to be insured against risks such as theft or accidental damage. Apart from these factors, there is little information available about AT for persons with disabilities. Teacher education on how to support learners who are visually impaired, and ongoing support for learners and their families, is problematic. There are often no clear procedures set out for teachers and parents to learn how and who can get access to AT devices, which devices are available and suitable, and how to get funding or payment options for their provision (Alper and Raharinirina, 2006). There is also no process in place for learners to obtain devices when they leave school, thereby limiting their educational opportunities.

A further challenge is the environment in which AT devices are used and the level of knowledge required to use them. Even when AT devices are available, they may not be used; for example, the device might not fit the learner or suit the family's needs, or require maintenance that the family cannot provide. In some instances, the device might be too complex for the learning and home environment without additional support. It is important that suitable AT devices are matched to individual learners.

2.2   Choosing suitable AT devices for learners who are blind or have low vision

Learners who are blind or have low vision will have differing needs, despite being in the same category of disability. What works well for one learner might not work well for another. The AT chosen for learners who are blind or have low

vision should reflect their unique strengths and needs, and the activities they need to do to be fully included in the curriculum.

AT for learners who are blind or have low vision should comprise instructional materials in appropriate media (including braille) to enable learners to communicate effectively, and enhance social competence and personal independence. AT would, therefore, need to allow learners who are blind or have low vision to learn through alternate media, using their other senses and alternate modes of learning. The following factors are important to consider when selecting AT for learners who are blind or have low vision.

› **Universal Design for Learning (UDL) principles**

The UDL philosophy or framework is defined more fully in Section 3. However, its principles of representation, expression and engagement, will inform the selection of AT devices. AT devices should:

- present information and enable the acquisition of information and knowledge in different ways (*representation*);
- differentiate the ways in which learners can express what they know (*expression*); and
- allow learners to deepen their engagement and interest in the world around them through an array of learning activities that are accessible to learners with different abilities (*engagement*).

› **Learning programme/curriculum requirements**

Different subjects require different types of engagement. AT devices should empower learners to engage in activities across the curriculum.

› **Family involvement and support**

Family involvement in the selection and use of AT is often neglected, despite it being important for children to generalise skills at home as part of their overall development. Without the support of families, there is a risk of AT devices being abandoned. Be mindful that many parents want to be active partners in supporting their child's learning, and will feel disrespected if they are not consulted when making these choices (Alper and Raharinirina, 2006). Where learners are based at hostels, the hostel staff function as family and need to be involved.

> **Socio-economic conditions of the learner's school and home environment**

  If AT devices cannot be utilised to their full potential due to a lack of knowledge or facilities at a school or place of care, they will not be used properly and, therefore, not achieve their goal. It is important to choose devices that will be used in school and at home.

2.2.1 Main types and examples of AT for learners who are blind or have low vision

There are different types of AT that learners who are blind or have low vision may use to increase their participation in teaching and learning activities, and fully cover the school curriculum. Where possible, it is wise to choose devices that are used by the general public that can be adapted through the use of apps to meet learners' needs. For example, for learners with low vision, using a smartphone can be beneficial where AT is costly (e.g. electronic magnifiers) or bulky (e.g. electronic braille). A single device can often perform multiple functions. Magnifier apps can turn smartphones into magnifiers with zoom, focus, light control, saving and sharing capabilities. Voice feedback on tablets can be used for teaching content and to access audio books. Smartwatches with haptic feedback can help people with visual impairment, particularly blind people, navigate between different places.

Table 2 lists some of the basic resources that learners who are blind or have low vision should have access to in their classroom. It also indicates resources that teachers can make use of when teaching learners who are blind or have low vision. Further specifications can be found in the Appendix.

Table 2: Recommended classroom resources for learners who are blind or have low vision

Degree of visual impairment		
	Blind	Partially sighted
Learners' resources	› Perkins Brailler › Braille paper › Braille eraser › Braille ring binder › Braille textbooks, maps, dictionaries (electronic), other LTSM › Tactile measuring instruments/devices › Talking calculators › Tactile models, graphic material for 'visual' and perceptual development › Access to computers with screen-reading software › White cane	› Bold-lined exercise books › Suitable pen/pencil, sometimes felt-tip pens, depending on eye-condition and acuity › Large-print textbooks, dictionaries and other LTSM › Magnification devices › Low-vision measuring instruments/devices › Simplified, bold-lined graphics › Calculators with good contrast/font size or talking calculators › Access to computers with suitable software
Teachers' resources	› Computers with specific software for developing LTSM in braille/large print › Access to a braille embosser and a braille graphics embosser › Access to a photocopier with enlargement functions › Access to scanners with suitable software › Access to braille curriculum documents and guidelines (if teachers are blind themselves) › Classrooms equipped with suitable assistive devices › Required specialised skills/training for teaching learners who are blind or have low vision and how to use the recommended resources › Access to braille curriculum documents and guidelines (if teachers are blind themselves) › Classrooms equipped with suitable assistive devices › Required specialised skills/training for teaching learners who are blind or have low vision and how to use the recommended resources		

Table 3 indicates the different categories of AT devices for learners who are blind or have low vision. It is helpful to know about these categories, their particular functions, and how they can assist in effective teaching and learning.

Table 3: Categories of AT devices for learners who are blind or have low vision

Category	Description
Braille technology	High-tech braille devices are available for people who are blind or have low vision to access and produce braille.
Non-optical low-vision devices	There are various non-optical devices that help people with low vision to access print and complete activities visually. There are also devices that adjust lighting, colour or print size (e.g. screen magnification software).
Low-tech and mid-tech devices for tactile learners	There are various low-tech and mid-tech devices that allow people who are blind to access and produce braille, complete Math activities, and activities of daily living in a tactile manner (i.e. touching and doing rather than seeing and doing).
Optical devices for near viewing	People with low vision may be prescribed optical devices for near viewing that will allow them to access standard-size print.
Optical devices for distance viewing	People with low vision may be prescribed optical devices for distance viewing that will allow them to access information and print at a distance.
Video magnifiers	Video magnifiers are a non-optical way of viewing print and information at a short distance. Some devices also have long distance capabilities. These use a stand-mounted or handheld video camera to project an image onto a screen.
Screen enlargement and readers	Some people can access information by using the magnification range built into computers. Others need to use additional magnification or screen-reading software.

Category	Description
Tactile graphics technology	The ability to read tactile graphics and charts is an essential part of blind literacy programmes.
Auditory access devices	Different devices are available for accessing auditory books, as well as materials and software to access information in auditory format.

Table 4 lists examples and functions of mid- and high-tech AT devices for learners who are blind or have low vision.

Table 4: Examples of mid- and high-tech AT devices for learners who are blind or have low vision

Mid-tech AT devices	Function
Large-print keyboard	High-contrast large-print keyboard.
Braille reader and note-taker	Portable device with braille display and keyboard for reading braille content and taking notes.
Manual braille writer	Mechanical typewriter device for typing braille on special braille paper.
Low- and medium-volume braille printer*	A braille printer/embosser is an impact printer that renders text as tactile braille dots using braille translation software, embossing on thicker braille paper to better retain the dots.
High-volume braille printer*	Same as low- and medium-volume braille printer, but capable of producing braille books at high speed and for extended periods (long service intervals).
Braille translation software	Software that translates text to braille for embossing on a braille printer/embosser and formats documents according to braille layout rules.
Digital voice recorder	Sound recording device most commonly used to record speech for later playback.

Mid-tech AT devices	Function
Audio labelling device	Device to label items with voice memos for later identification.
Desktop electronic magnifier	Device that uses a camera and a wide display screen to perform digital magnification and contrast of printed materials, suitable for long periods of reading.
Portable electronic magnifier	Device that usually connects to a monitor or a computer to perform digital magnification and contrast of printed materials, suitable for long periods of reading.
Mouse-type magnifier	Electronic device that usually connects to a TV to perform digital magnification and contrast of printed materials.
Electronic handheld monocular	Portable electronic device to view and magnify objects in the near distance and close up.
Optical magnifier	Convex lens that is used to produce a magnified image, usually mounted in a frame with a handle.
Tactile duplicator	Device to produce graphics using raised surfaces to convey non-textual information (e.g. tactile diagrams, maps and graphs).
Tactile touchpad and audio software	Incorporates audio feedback with tactile graphics, providing an interactive way to understand complex, visually-oriented information.
Handheld talking GPS	Device that voices street names, intersections and landmarks when approaching them.
Talking calculator	Calculator with audio feedback.
Large display calculator	Calculator with large display and buttons.
Navigational aid for the visually impaired	Wrist-worn navigational aid for increased awareness of obstacles.

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Mid-tech AT devices	Function
Cane-mountable electronic travel aid	Sensor-based technology that detects the presence of obstacles from knee to head height and pre-warns from a distance of up to a few metres.
Handheld electronic magnifier	Device with a built-in camera and a small LCD screen to perform digital magnification and contrast of printed materials, suitable for limited periods of reading.

High-tech AT devices	Function
Screen magnification software	Software application that presents computer screen content with magnification, colour contrast, and pointer and cursor enhancements.
Screen reading software	Software application that converts what is displayed on a computer screen into synthesised speech and braille output (braille display required for braille output).
Refreshable braille display	Device for displaying braille characters, usually by means of round-tipped pins raised through holes in a flat surface. Blind computer users use it to read text output.
Keyboard literacy software	Software to teach keyboard touch typing skills (typing without using the sense of sight to find the keys).
Braille personal digital assistant*	Portable device usually with braille or QWERTY keyboard for integrated computing experience, with speech synthesiser and braille display.
Optical character recognition*	Scans printed documents or electronic files and converts them into electronic text, for speech or braille output.

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High-tech AT devices	Function
Simple computing environment	Bundle of easy-to-use software programs including user interface, email creation, word processing, book reading and internet access.
Specialised e-Reader*	Accessible mobile electronic device that is designed primarily for reading digital publications such as e-books and periodicals.
Multimedia player	Portable multimedia player, e-book reader and optional voice recorder.
DAISY reading software	Software for reading documents in DAISY format (an audio substitute for print material).
Tactile graphics producing software	Software to produce images using raised surfaces to convey non-textual information (e.g. tactile pictures, diagrams, maps and graphs).
TapTapSee*	Application for Apple mobile phones designed to help people who are blind or have low vision identify objects they encounter in their daily lives.
Mathematics software	Software used to create mathematical notation for inclusion in braille translation software.

* Potentially unavailable in South Africa

Section

3

SECTION 3

Using AT devices

This section includes information about how a teacher or facilitator can use AT devices in the classroom to assist learners who are blind or have low vision. We define and explain the purpose and principles of UDL in relation to the use of AT, and highlight its influence on the effective use of AT devices. We then look at the effective implementation of AT in the classroom, and illustrate the importance of using the correct AT devices to achieve specific learning outcomes for particular learning areas or subjects.

After reading this section, you will be able to:

> Define UDL and explain its principles.

> Describe how UDL principles affect the choice of AT devices.

> Outline things that need to be taken into consideration when using AT devices effectively in the classroom

> Give examples of mid- and high-tech AT devices that help learners who are blind or have low vision to reach specific learning outcomes.

3.1 Universal Design for Llearning (UDL)

UDL is a research-based framework or approach to teaching and learning that helps to make education accessible to all learners. It is based on the notion that the needs of all learners should be accommodated during the design, implementation and teaching of learning stages and activities. It promotes a set of principles for curriculum development that gives all learners equal opportunities to learn (Sadao and Robinson, 2010).

UDL principles can be adopted to ensure that AT devices are chosen and used in a way that best suits individual learners. They encourage flexible ways of using devices, which are customised and adjusted for individual needs, and do not subscribe to a one-size-fits-all approach. The ultimate purpose of UDL is to increase access to learning for all learners by removing barriers that impede involvement and engagement.

3.1.1 Principles of UDL

In Section 2, UDL principles were applied to the selection of suitable AT devices for learners who are blind or have low vision. We will now look more broadly at how UDL principles could be applied to the use of AT.

The three overarching principles of UDL that should guide curriculum design, the selection and planning of teaching and learning activities, and the selection of AT for the classroom and individual learners, are:

› **Representation:** Giving learners various ways of acquiring information and knowledge. This means that information and content is presented in different ways, and that different methods of teaching and reaching learning goals are used.

› **Expression:** Differentiating the ways that learners can express what they know. This means that learners are allowed to communicate what they know through various modes of expression, and can demonstrate their proficiency or mastery of a skill through a variety of means.

› **Engagement:** Stimulating interest and motivation for learning using content that is suitable for the varied levels of abilities and preferences/interests of learners. This is achieved by facilitating options and choices of activities and resources.

Table 5 indicates the AT devices that can be used to practically apply the UDL principles while teaching learners who are blind or have low vision.

Table 5: AT devices for learners who are blind or have low vision that enable the practice of UDL principles

UDL principle	AT devices
Representation	**Mid-tech**
Enabling multiple ways of presenting content	› Braille reader and note-taker › Low- and medium-volume braille printer › Digital voice recorder › Desktop electronic magnifier › Portable electronic magnifier › Handheld electronic magnifier › Electronic handheld monocular › Optical magnifier › Braille translation software › Tactile touchpad and audio software › Handheld talking GPS › Navigational aid for the visually impaired › Cane-mountable electronic travel aid
	High-tech
	› Screen reading software › Refreshable braille display › Braille Personal Digital Assistant › Optical character recognition software and hardware › Simple computing environment › Braille translation software › Specialised e-Reader › DAISY reading software › Screen magnification software › Tactile graphics producing software › TapTapSee › Mathematics software

UDL principle	AT devices
Expression	**Mid-tech**
Enabling learners to communicate what they know and can do through various means	› Large-print keyboard › Manual braille writer › Tactile duplicator › Digital voice recorder › High-tech
	High-tech
	› Keyboard literacy software › Tactile graphics producing software › TapTapSee › Simple computing environment
Engagement	**Mid-tech**
Enabling the facilitation of choices of learning activities to cater for varied abilities of learners	› Audio labelling device › Mouse-type magnifier › Braille translation software › Tactile duplicator › Tactile touchpad and audio software › Optical magnifier › Handheld talking GPS › Navigational aid for the visually impaired › Cane-mountable electronic travel aid
	High-tech
	› Screen reading software › Multimedia player › Keyboard literacy software › Simple computing environment › Tactile graphics producing software › Specialised e-Reader › Mathematics software › TapTapSee

3.2   AT devices in the classroom

Every school subject has different types of knowledge and skills that learners need to acquire. Different AT devices will be required depending on the types of teaching and learning activities planned for the different subjects making up the school curriculum.

In this short guide, we look at AT devices that can assist learners who are blind or have low vision to achieve specific learning outcomes in FP CAPS subjects (DBE, 2011a, b, c). However, these devices can also be used in the Intermediate Phase, Senior Phase, and Further Education and Training. For example, the devices specified for Home Language could also be used for other languages.

Table 6 indicates the AT devices recommended by the DBE for each subject in the FP curriculum. Further specifications can be found in the Appendix.

Table 6: DBE-recommended AT devices for FP CAPS subject topics/skills

Topics/skills	Recommended AT devices
Home Language	
Reading and phonics	‣ Keyboard literacy software
	‣ Screen magnification software
	‣ Large-print keyboard
	‣ Screen reading software
	‣ Refreshable braille display
	‣ Braille reader and note-taker
	‣ Braille personal digital assistant
	‣ Optical character recognition software and hardware
	‣ Simple computing environment
	‣ Manual braille writer
	‣ Low- and medium-volume braille printer
	‣ High-volume braille printer
	‣ Braille translation software
	‣ Specialised e-Reader
	‣ Multimedia player
	‣ Digital voice recorder
	‣ Audio labelling device
	‣ DAISY reading software

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Topics/skills	Recommended AT devices
Writing and handwriting	‣ Electronic handheld monocular ‣ Optical magnifier ‣ Tactile graphics producing software ‣ Tactile duplicator ‣ Tactile touchpad and audio software ‣ TapTapSee
Mathematics	
Numbers, operations and relationships	‣ Electronic handheld monocular ‣ Mathematics software ‣ Tactile graphics producing software ‣ Tactile duplicator ‣ Tactile touchpad and audio software ‣ Talking calculator ‣ TapTapSee
Patterns, functions and algebra	‣ Electronic handheld monocular ‣ Large display calculator ‣ Mathematics software ‣ Tactile graphics producing software ‣ Tactile duplicator ‣ Tactile touchpad and audio software ‣ Talking calculator ‣ TapTapSee
Space and shape (geometry)	‣ Electronic handheld monocular ‣ Mathematics software ‣ Tactile graphics producing software ‣ Tactile duplicator ‣ Tactile touchpad and audio software ‣ Talking calculator ‣ Navigational aid for the person who is blind or has low vision ‣ Cane-mountable electronic travel aid ‣ TapTapSee

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Topics/skills	Recommended AT devices
Measurement	› Electronic handheld monocular › Large display calculator › Mathematics software › Tactile graphics producing software › Tactile duplicator › Tactile touchpad and audio software › Talking calculator
Data handling (statistics)	› Electronic handheld monocular › Mathematics software › Tactile graphics producing software › Tactile duplicator › Tactile touchpad and audio software › Talking calculator › TapTapSee
Life Skills	
Beginning knowledge and personal and social well-being	› Electronic handheld monocular › Optical magnifier › Tactile graphics producing software › Tactile duplicator › Tactile touchpad and audio software › Navigational aid for the person who is blind or has low vision › Cane-mountable electronic travel aid › Handheld talking GPS › TapTapSee
Creative arts	› Tactile graphics producing software › Tactile duplicator › Tactile touchpad and audio software › Navigational aid for the person who is blind or has low vision › Cane-mountable electronic travel aid

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Topics/skills	Recommended AT devices
Physical education	› Electronic handheld monocular › Navigational aid for the person who is blind or has low vision › Cane-mountable electronic travel aid › Handheld talking GPS

3.2.1 Implementing AT in the classroom

After selecting the most suitable AT device(s) to reach specific learning outcomes, there are other aspects that need to be considered when using AT in the classroom.

The following aspects of AT use and inclusive education need to be considered for successful, sustainable AT implementation (Alper and Raharinirina, 2006):

1. The AT devices need to fit with the learner's family's goals and values for their child's learning.

2. The AT devices need to be fully integrated into the learner's learning programme (i.e. they are not used when 'thought of' or as 'an add-on', but are incorporated in the planning of teaching and learning activities.

3. Family members, teachers, facilitators, support professionals and the learner work collaboratively to experiment with and use various AT devices, in order to reach learning outcomes for the learner optimally.

4. Communication among the aforementioned people is ongoing.

5. AT devices and accompanying equipment are maintained, replaced or modified as needed.

6. Problems experienced with the use of AT devices are resolved as quickly as possible.

While the focus of this guide has been on the selection and use of AT devices for learners who are blind or have low vision, it is important to note that the categories of AT for different types of disabilities are not mutually exclusive and can co-exist. For example, a child with low vision may also have difficulty communicating and have an intellectual disability. It is recommended that

teachers, facilitators and carers of learners with any type of disability, become familiar with AT devices that can be used to assist learners with other types of sensory and intellectual disabilities.

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Appendix

APPENDIX

This Appendix presents the devices recommended in the DBE's 'Draft National Guidelines for Resourcing an Inclusive Education System - Annexure A' (2018) for visually impaired learners (blind, low vision, deafblind).

The DBE's draft national guidelines document offers more AT device recommendations for a broad range of disabilities, some of which may also assist learners who are visually impaired. It is therefore advised that you not only read the other TEDI short guides on AT devices, but also refer to the guidelines published by the DBE.

Devices to assist learners with visual impairments (blind, low vision, deafblind)

Product Type	Functional Description	General Specifications
Desktop Electronic Magnifier	Device that uses a camera and a wide display screen to perform digital magnification and contrast of printed materials, suitable for long periods of reading.	› Typically 20" or larger screen › High definition autofocus camera › At least 30x magnification › Display real-time view of document › Adjustable magnification level › Colour contrast options › Built-in XY table available on certain models › Ability to write under the camera › Optional distance viewing › Optional speech feedback

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Product Type	Functional Description	General Specifications
Portable Electronic Magnifier	Device that usually connects to a monitor or a computer to perform digital magnification and contrast of printed materials, suitable for long periods of reading.	› Connect to a monitor via HDMI or to a computer via USB › High definition autofocus camera › At least 30x magnification › Distance viewing, document reading and self-view › Colour contrast options › Ability to write under the camera › Optional XY table available for certain models › Compatible with most popular screen magnification software › Optional speech feedback
Handheld Electronic Magnifier	Device with a built-in camera and a small LCD screen to perform digital magnification and contrast of printed materials, suitable for limited periods of reading.	› From 3" to 8" screen size › High definition autofocus camera › At least 10x magnification › Accessible settings adjustment › Colour contrast options › Freeze image function › Handle and/or reading stand › Optional HDMI output › Rechargeable battery and charger
Mouse-type Magnifier	Electronic device that usually connects to a TV to perform digital magnification and contrast of printed materials.	› Connect to a TV via composite port › At least 28x magnification › Colour contrast options › Optional computer compatibility
Electronic Handheld Monocular	Portable electronic device to view and magnify objects in the near distance as well as close up.	› At least 16x magnification › Colour contrast options › Large field of view › Rechargeable battery and charger

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Product Type	Functional Description	General Specifications
Optical Magnifier	Convex lens that is used to produce a magnified image, usually mounted in a frame with a handle.	› Different fixed magnification levels › Multiple models: › Handheld or Stand › Bar or Dome › Distance or Near object glasses
Keyboard Literacy Software	Software to teach keyboard touch typing skills - typing without using the sense of sight to find the keys.	› Accessible to blind and low vision users › Spoken and displayed instructions › Audio feedback when typing › Built-in curriculum and ability to create own lessons › Progress reports
Screen Magnification Software	Software application which presents computer screen content with magnification, colour contrast and pointer and cursor enhancements.	› Magnification up to 60x › Different magnification views › Multiple colour schemes › Pointer and cursor enhancements › Dual-monitor support › Optional touch screen gestures › Optional screen reading feature with human-sounding text-to-speech synthesiser › Different reading views › Create user profiles according to personal requirements › Optional portable USB licence key › Compatible with Windows 7 and newer
Large-Print Keyboard	High-contrast large-print keyboard.	› Full-size keyboard › Large-print bold keycaps › Different colour schemes › Optional feature keys › USB connection › Compatible with Windows 7 and newer

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Product Type	Functional Description	General Specifications
Large Display Calculator	Calculator with large display and buttons.	‣ Basic arithmetic operations ‣ Percentage, square root, raise a number to a given power ‣ Memory keys ‣ Optional scientific functions ‣ Optional speech output ‣ Battery-operated
Screen Reading Software	Software application which converts what is displayed on a computer screen into synthesised speech and braille output (braille display required for braille output).	‣ Human-sounding text-to-speech synthesiser ‣ Full access to Windows, MS Office applications and web browsers ‣ Braille output support ‣ Quick navigation keys to jump through MS Word documents, PDF files and web pages ‣ Built-in OCR feature ‣ Optional portable USB licence ‣ Compatible with Windows 7 and newer
Refreshable Braille Display	Device for displaying braille characters, usually by means of round-tipped pins raised through holes in a flat surface. Blind computer users use it to read text output.	‣ Available in 14 to 80 cell models ‣ Braille keyboard to input text and commands ‣ Function keys for basic navigation ‣ Optional cursor routing keys ‣ Connect via USB or Bluetooth ‣ Compatible with most popular screen reading software ‣ Compatible with Windows, Mac OS, iOS, Android
Braille Reader and Note-taker	Portable device with braille display and keyboard for reading braille content and taking notes.	‣ 14 to 40 refreshable braille cells ‣ Read braille content from SD card ‣ Simple note-taking capability ‣ Connect to a computer or portable device via USB or Bluetooth ‣ Rechargeable battery and charger

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Product Type	Functional Description	General Specifications
Braille Personal Digital Assistant	Portable device usually with braille or QWERTY keyboard for integrated computing experience, with speech synthesiser and braille display.	› 14 to 40 refreshable braille cells with cursor routing keys › Read any content in speech, braille or both, with support for multiple languages › Stereo speakers and microphone › Built-in productivity applications › Access to mainstream apps › Internal flash memory and USB/SD card support for expendable storage › Wi-Fi, Bluetooth and optional GPS › Optional touch screen input › Optional camera for OCR capture › Connect to a computer or portable device via USB or Bluetooth › Rechargeable battery and charger
Optical Character Recognition (OCR) Software and Hardware	Scan printed documents or electronic files and convert them into electronic text, for speech or braille output.	› Automatic capture and read › A4 document size minimum › Single and multi-page capture › Optional visual enhancements of resulting text › Convert scanned and PDF files into readable and editable format › Optional feature to save as MP3 › Available as software or specialised hardware device

Product Type	Functional Description	General Specifications
Simple Computing Environment	Bundle of easy-to-use software programmes including user interface, email creation, word processing, book reading and internet access.	› Simplify ways to perform computing tasks › Menus with magnification, high-contrast colours and speech output › Requires minimal computer knowledge or touch typing skills › Most tasks accomplished by Enter, Escape and the Arrow keys › Can be turned off to access the standard Windows environment
Manual Braille Writer	Mechanical typewriter device for typing braille on special braille paper.	› Typewriter-style device to produce braille manually › Six-key braille keyboard › Paper size up to 11" x 11.5"
Low and Medium Volume Braille Printer	A braille printer/ embosser is an impact printer that renders text as tactile braille dots using braille translation software, embossing on thicker braille paper to better retain the dots.	› Up to 100 characters per second (300 pages per hour) › Tractor-fed or cut-sheet paper › Single and double-sided printing › Able to produce tactile graphics › USB, Ethernet or Wi-Fi connection › Compatible with Windows 7 and newer
High Volume Braille Printer	Same as low and medium volume braille printer, but capable of producing braille books at high speed and for extended period. Long service intervals.	› Up to 650 characters per second (1950 pages per hour) › Tractor-fed, cut-sheet or reel paper › Single and double-sided printing › USB, Ethernet or Wi-Fi connection › Compatible with Windows 7 and newer

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Product Type	Functional Description	General Specifications
Braille Translation Software	Software that translates text to braille for embossing on a braille printer/embosser and formats documents according to braille layout rules.	› Supports all major South African languages as well as Unified English Braille Code (UEB) › Offers contracted and uncontracted braille › Accessible for blind users › Compatible with Windows 7 and newer
Mathematics Software	Software used for creation of mathematical notation for inclusion in braille translation software.	› Interactive equation editor › Integrate with leading braille translation software which must support UEB Maths › Compatible with Windows 7 and newer
Tactile Graphics Producing Software	Software to produce images using raised surfaces to convey non-textual information e.g. tactile pictures, diagrams, maps and graphs.	› Convert images to tactile graphics › Include basic drawing and editing tools › Compatible with most graphics capable braille printers/embossers › Compatible with Windows 7 and newer
Tactile Duplicator	Device to produce graphics using raised surfaces to convey non-textual information e.g. tactile diagrams, maps and graphs.	› Reproduce tactile graphics using swell paper or plastic-like paper › Resulting tactile graphics can be examined using hands › Option to make multiple copies from an original
Tactile Touchpad and Audio Software	Incorporate audio feedback with tactile graphics, providing interactive way to understand complex, visually-oriented information.	› Creates audio-tactile graphics from standard image formats › Offers different types of textures for ease of interpretation › Includes OCR software › Touchpad A4 size minimum › USB connection

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Product Type	Functional Description	General Specifications
Specialised e-Reader	Accessible mobile electronic device that is designed primarily for the purpose of reading digital publications such as e-books and periodicals.	› Adjustable font size › Text-to-speech › Adjustable background colour scheme › Accessible menus (voice over) › Optional adjustable font colour scheme
Multimedia Player	Portable multimedia player, e-book reader and optional voice recorder.	› Support variety of audio, text, e-book and DAISY files › Built-in text-to-speech › Support for bookmarks › High-quality recordings and built-in microphone on devices with recording capabilities › Built-in speaker and earphone connection › Support for memory card › USB connection for PC transfers › Optional wireless connectivity › Rechargeable battery and charger
DAISY Reading Software	Software for reading documents in DAISY format.	› Full navigational features through the document › Output in synchronised speech and text › Compatible with Windows, Mac OS, iOS or Android
Digital Voice Recorder	Sound recording device most commonly used to record speech for later playback.	› High-quality recordings and playback › Built-in microphone › Built-in speaker › Minimum 8 hours of recording time › USB connection for downloading recordings to PC › Battery-operated

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Product Type	Functional Description	General Specifications
Talking Calculator	Calculator with audio feedback.	‣ Basic arithmetic operations ‣ Percentage, square root, raise a number to a given power ‣ Memory keys ‣ Optional scientific functions ‣ Speech output, adjustable volume ‣ Optional large display and buttons ‣ Earphones connection ‣ Battery-operated
Audio Labelling Device	Device to label items with voice memos for later identification.	‣ Items such as CDs and classroom objects can be labelled ‣ Record a description (voice memo) of the item ‣ The device identifies the item and speaks the recorded memo
Navigational Aid for the Visually Impaired	Wrist-worn navigational aid for increased awareness of obstacles.	‣ Ultrasonic waves detect obstacles and device's vibrations intensify to alert the user ‣ Fast-sensing technology ‣ Water resistant
Cane Mountable Electronic Travel Aid	Sensor-based technology that detects the presence of obstacles from knee to head height and pre-warns from a distance of up to a few meters.	‣ Cane mountable device to allow one-handed operation ‣ Vibratory feedback of distance information ‣ Assist in safe and independent mobility ‣ Support for short range of detection (indoor and crowded places) and long range (outdoor) ‣ Easily detachable from the cane ‣ Audio alarms for indicating battery and charging status, sensor and vibrator failure ‣ Rechargeable battery

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Product Type	Functional Description	General Specifications
Handheld Talking GPS	Device that voices street names, intersections and landmarks when approaching them.	› Audio feedback as the person walks › Announce location and surrounding areas › Customised route can be set › Route can be reversed

The Teacher Empowerment for Disability Inclusion (TEDI) project aims to empower teachers and carers to provide quality education for children with severe to profound sensory or intellectual impairments through training that is focused on inclusivity, diversity and addressing learners' disability-specific needs.

This short guide is aimed at teachers and facilitators working and interacting with learners who are blind or have low vision. It responds to the need for these practitioners to understand more about assistive technology, enable them to identify the need for technology, and assist with the selection of appropriate devices. Guidelines are provided on how technology can be used to support teaching and learning across the curriculum. This short guide adopts a practical, skills-based approach and is aligned with the Department of Basic Education's policy framework and learning programmes.

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