



SG ENABLE ONLINE HRM SERIES FOR EMPLOYERS

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# ASSISTIVE TECHNOLOGY AND E-ACCESSIBILITY

Developed by:

**SG ENABLE**  
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Singapore

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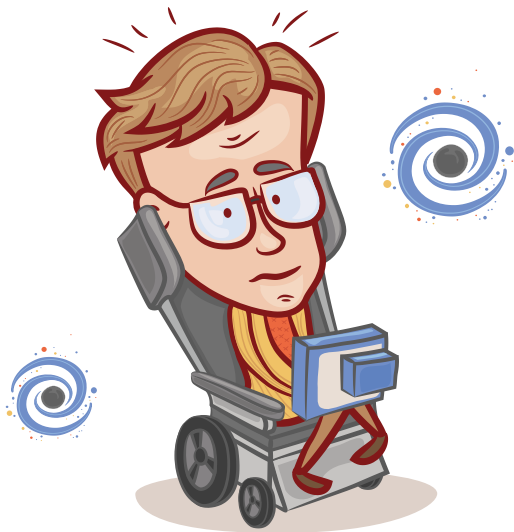
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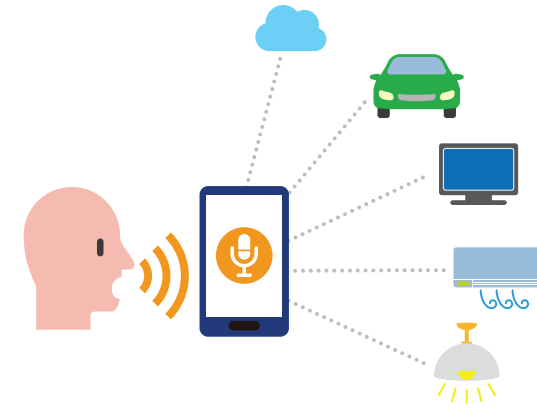
Enhancing Capabilities Through Assistive  
Technology and e-Accessibility

## 1. ENHANCING CAPABILITIES THROUGH ASSISTIVE TECHNOLOGY AND E-ACCESSIBILITY

Stephen Hawking is a well-known English theoretical physicist, cosmologist, author and Director of Research at the Centre for Theoretical Cosmology in the University of Cambridge. Hawking has a rare early-onset slow-progressing form of amyotrophic lateral sclerosis (ALS). As a result, he is gradually paralysed over the decades, which affects his physical abilities and even ability to communicate via speech. To enable himself to 'speak', Hawking uses a voice synthesiser whereby he moves his cheek muscle to select the pre-installed words or phrases to be 'spoken' on his behalf. Voice synthesiser is an example of assistive technology (AT) device.



Smart mobile devices these days have in-built screen reader or voice-enabled assistant (eg. Siri or Google Assistant). The devices read out the content and allow users to give commands, using voice. The implementation of such AT makes smart mobile devices more accessible for users who are visually impaired, or have difficulties in reading or using the phones physically. However, it is important to note that this in-built screen reader or voice-enabled assistant will only work when the content on their device is made accessible for them (e.g. through having alternative text to describe image files in slides or documents, otherwise the screen reader will not be able to describe the image. As a result, persons with visual impairment would not be able to obtain any information about the image or object). Hence, the usage of AT is only optimised in the presence of accessible content (also known as "e-Accessibility").



The two examples above showcase the nature and importance of how AT and e-Accessibility empowers persons with disabilities and us, the general public. Besides the use of these technology in personal lives for independent living, they can also be implemented in the area of employment and work. This guide will cover the following concepts of AT and e-Accessibility at work, and recommend various solutions which employers and persons with disabilities can consider to adopt, to support job accommodation and improve access to employment.

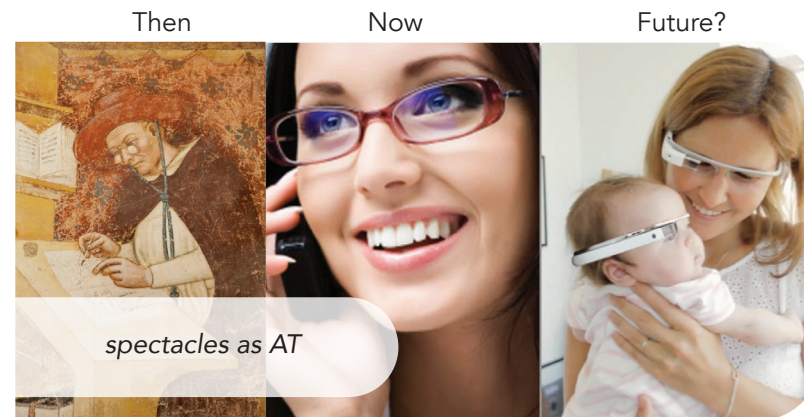
# 02

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Basics of Assistive Technology

## 2. BASICS OF ASSISTIVE TECHNOLOGY

Assistive technology (AT) can be defined as “any piece of equipment, or product, whether it is acquired commercially, modified, or customised, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities”<sup>1</sup>. Voice synthesiser, powered wheelchair and sip-and-puff tube are some examples of AT devices.

It is common to assume that AT devices are used only by persons with disabilities. Although it is true to a certain extent, AT has evolved and advanced to a stage where it enables the lives of not just persons with disabilities, but for everyone. E.g. When spectacles were first introduced in 1286, it was considered a medical device – a form of AT. Today, wearing spectacles have become a common sight amongst the public that it has now become a lifestyle item. As technology advances, the simple functionality of spectacles (corrective lenses) is transforming into sophisticated smart glasses (a wearable computer that adds information to what the wearer sees), which will benefit all of us, with or without disabilities. Over the years, technology that is used in our daily lives such as mobile phones and computers have also evolved to become the springboard for the creation of numerous new AT applications (i.e. screen magnifiers, text-to-speech readers, 3-D printing, automation etc.), thus enabling persons with disabilities to have better access to education, social interactions and work. Therefore, the potential of AT to enable each of us to achieve the optimal level of performance can be said to be limitless.



# 03

— Basics of e-Accessibility  
(Accessible Content)

### 3. BASICS OF E-ACCESSIBILITY (ACCESSIBLE CONTENT)

The usage of assistive technology (AT) is optimised in the presence of accessible content. This is also known as e-Accessibility. Electronic Accessibility, or e-Accessibility, can be defined as “the ease of use of information and communication technologies, such as the Internet, by all users including people with disabilities.”<sup>2</sup>

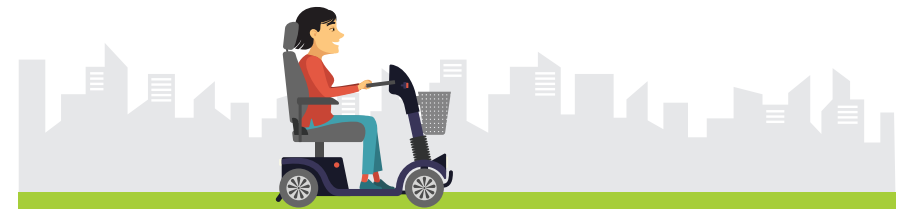
Imagine yourself as a jobseeker with visual impairment, and you intend to apply for a job through the online job portal. Upon clicking ‘Apply’, you are directed to the employers’ e-recruitment system. As you fill in a series of online forms, you are frustrated with what the screen-reader software has been reading out to you. This is because the layout of questions and fields for each page and section is inconsistent. By the time you have figured out, the system’s ‘time-out’ function causes you to lose the data you have previously keyed in. You either restart the process or give up. This scenario highlights the importance for employers to consider making website content more accessible to persons with disabilities and more compatible with their assistive technologies i.e. screen-reader in this example.



Accessible content benefits all users because it renders products and services friendly to users from all walks-of-life and of different capabilities, not just for persons with disabilities. Therefore, it would be a strong business case (i.e. greater return-on-investment, greater productivity, growing market share) to adopt accessible content in products, services and processes for consumers and employees.

#### ENABLING FACT

The Partnership on Employment and Accessible Technology (PEAT) website houses information, tips and videos to help employers develop accessible technology capability. To find out more, please visit <http://www.peatworks.org/>





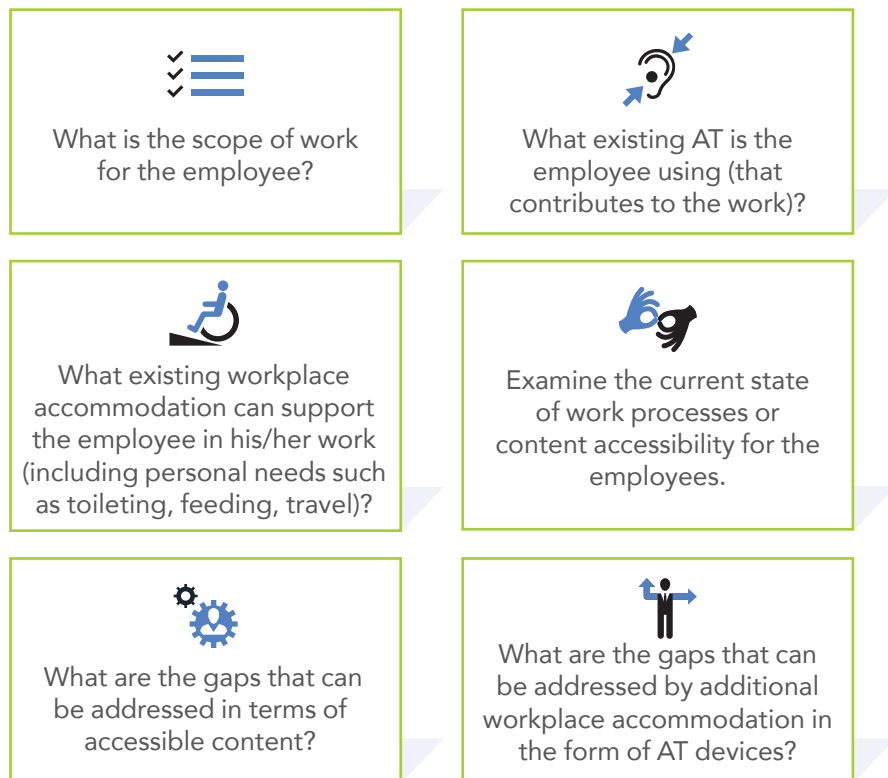
# 04

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Understanding the Needs of  
the Employee

## 4. UNDERSTANDING THE NEEDS OF THE EMPLOYEE

To determine which assistive technology (AT) device to use, we need to understand the needs of the employee in the context of the work environment and the tasks that he/she will be required to perform at work.

It would be important to discuss with your employee on the workplace accommodation required. Some examples are making content more accessible and/or the usage of additional AT devices. Below are some guiding questions to consider:



## HOW SHOULD THESE GAPS BE FILLED?

The needs of every employee are different even if they have similar disabilities. As such, it is necessary for employers to discuss with every employee about his/her accommodation and AT needs to allow him/her to perform the essential functions of the job and enjoy equal opportunities of employment.

After understanding the needs of your employee with disability and identifying the gaps to be filled, employers can learn more about the types of AT devices available and how to make content accessible in order to fill these gaps. After which, employers should consider various key factors on cost, level of technology etc (to be discussed in chapter 7) to assess which types of AT devices and accessible content to implement.

The next few sections will elaborate on the following topics:

- Types of Assistive Technology Devices
- How to provide Accessible Content (Documents, Materials and Websites)
- Key Considerations for Adopting Assistive Technology or Accessible Content

# 05

Types of Assistive Technology Devices



## 5. TYPES OF ASSISTIVE TECHNOLOGY DEVICES

There are a variety of AT devices and solutions that will enable persons with disabilities to overcome barriers in their daily tasks and at work, thus enabling them to be independent and productive at work. For most persons with disabilities, they would already have their own set of AT devices to serve their daily needs, but employers can do more to help employees with disabilities perform better at work.

The following chart suggests some examples of AT describing specific options for employees with (a) physical disabilities, (b) visual impairments, (c) hearing impairments, and (d) autism/ intellectual disabilities. Employers could consider getting some of these devices to help employees with disabilities at work. The following examples are intended as illustrations; it is most important that employers discuss and review the individual needs of their employees with the employee, the line supervisors and managers.

*Disclaimer: These technologies and devices are accurate and up to date as of May 2020. As technology is always evolving, some of these devices or apps mentioned in the chart below may be rendered obsolete overtime. Hence it is important to always keep abreast of technological advancements. The information of the products and services presented in the examples is not an endorsement by SG Enable.*

### A. EXAMPLES FOR PERSONS WITH PHYSICAL DISABILITIES

AREA TO ADDRESS	ASSISTIVE TECHNOLOGY DEVICE/SOLUTION	APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK
<b>Mobility</b>	Enhanced Motorised Wheelchair 	Some motorised wheelchairs are more than just a travelling aid. E.g. an elevating wheelchair enables the wheelchair user to extend their reach and retrieve items from higher shelves, or converse with colleagues and customers at eye level.
	Height Adjustable Desk 	Height adjustable desk allows wheelchair users to adjust their work desk height/angle to one that best suits their comfortable working posture.

## AREA TO ADDRESS

## ASSISTIVE TECHNOLOGY DEVICE/SOLUTION

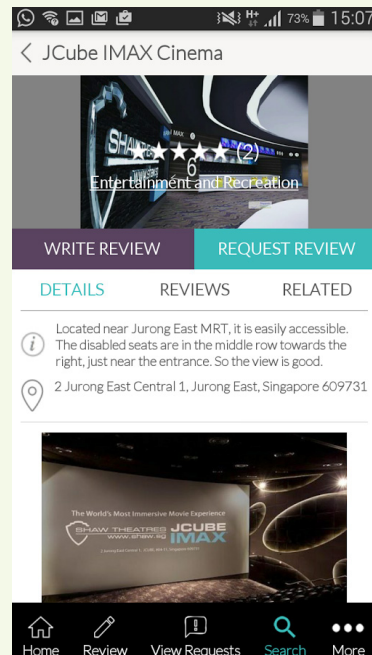
## APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK

### Portable Ramp



Portable ramps can be used to navigate areas in the workplace or meeting places where it is not so accessible, or to get on stage to give a speech etc. These portable ramps are easy to carry around and deploy, with built-in handles and no installation required.

### Assisted Travel Mobile Application



Today, with the ease of smartphones, there are many free mobile applications available which collates information and reviews the accessibility of venues in Singapore.

The "AllGoEasy" free platform is one such example for wheelchair users to plan their journeys and find out if their destination (meeting or conference venue) is wheelchair accessible.

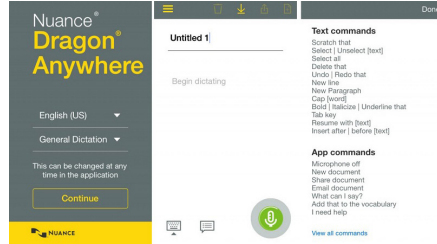
**AREA TO ADDRESS**

**ASSISTIVE TECHNOLOGY DEVICE/SOLUTION**

**APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK**

**Accessing Computers**

Speech Recognition Software/ Dictation Software  
*E.g. Dragon Naturally Speaking Software*



Persons with upper body mobility impairments experience difficulties in lifting their arms to type on the computer, or move the computer mouse. Speech recognition software is now commercially available for them to execute commands for typing, sending emails and even surfing the internet just by speaking.

Compact Keyboard



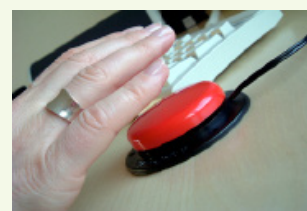
Alternative keyboards such as compact keyboards are available for persons with limited reach or strength in one arm. These compact keyboards are narrower and requires lesser effort to move across keys.

Keyguard



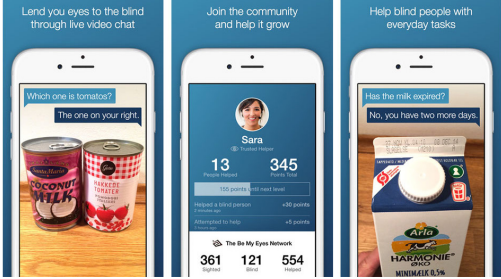

The keyguard is a simple hard plastic add-on for the computer keyboard with holes for each key. A user is able to rest their hands on top of the keyguard while typing to reduce the strain on the upper limb, and avoid striking unwanted keys due to involuntary muscle contractions (which may be caused by cerebral palsy, muscular dystrophy or stroke). This will enable them to do administrative work faster.

Switch Button



Persons with poor fine motor skills and weaker arms dexterity to control the mouse, can opt to use switch buttons. These switch buttons have a wider surface area for navigating and selecting icons on the computer screen. It can also be configured to drive various software and commands such as 'Enter', 'Right Click'.

## B. EXAMPLES FOR PERSONS WITH VISUAL IMPAIRMENT

AREA TO ADDRESS	ASSISTIVE TECHNOLOGY DEVICE/SOLUTION	APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK
<p><b>Identifying Environment</b></p>	<p>Assisted Visual Mobile Application</p> <p>1. Be my eyes</p>  <p>2. Tap Tap See</p>  <p>Picture 1 is black logitech computer mouse beside black ceramic mug...</p>	<ol style="list-style-type: none"><li>1. "Be my eyes" is an iOS app that connects the visually impaired with sighted helpers/volunteers from around the world via live video connection, to be their eyes and assist with their requests to identify objects or read a document to them.</li><li>2. "TapTapSee" is an app (available both in iOS and Android) which allows the visually impaired to take a photo of the surroundings/object and uses crowdsourcing and image recognition to identify the object/surroundings. Highly accurate descriptions.</li></ol> <p>Naturally, co-workers would be the eyes for their blind colleagues in the form of natural support at work. Employers could adopt a buddy system to help them at work, or encourage co-workers to register as volunteers for mobile applications e.g. "Be my eyes" and go one step further to respond to requests from the blind to identify objects/ surroundings.</p>

## AREA TO ADDRESS

### Accessing Computers

## ASSISTIVE TECHNOLOGY DEVICE/SOLUTION

### Screen Reader



## APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK

A screen reader is a software application that identifies, interprets and re-presents what is being displayed on the screen to the user either through synthesised voice, sound icons, or a Braille output device.

The commonly used software products are Job Access with Speech (JAWS), Window-Eyes and NonVisual Desktop Access (NVDA). All of these software have similar functions and are compatible with many operating systems and software applications such as Microsoft Office, internet browsers and even call centre systems such as Avaya.

These products enable persons with visual impairments to take on administrative-based (e.g. research, financial accounting, secretariat) work and customer service jobs.

### Large-font Keyboard



Large-font keyboards feature large font print, and some have high colour contrast for greater visibility. It enables persons with tunnel vision, low vision or colour blindness to recognise the keys and type easily.



## AREA TO ADDRESS

Accessing Documents and Hardcopy Materials

## ASSISTIVE TECHNOLOGY DEVICE/SOLUTION

Screen Magnifier



## APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK

Screen magnifier software enlarges all the data on screen i.e. including the mouse cursor, fonts, icons and notifications. Widely used operating systems such as Microsoft Windows and Apple Macintosh have in-built "Accessible" mode magnifiers, or is compatible with downloadable magnifier freewares, which may suffice for some individuals' (with low vision) needs.


However, with these in-built or free screen magnifiers, the clarity of the text may be degraded in the magnified view. So depending on the needs of the person with visual impairment, employers may need to purchase and install better screen magnifier software which enables higher magnification levels without compromising on the screen resolution. Some screen magnifier software will also help to adjust the colour contrast of the information on screen, customising it to the individual's preferred visual colours.

One such example of commonly-used screen magnifier software is "Zoomtext". Besides magnification, Zoomtext also comes with functions to allow colour-contrast and text-to-speech narration, which enables persons with a wider range of visual impairment.

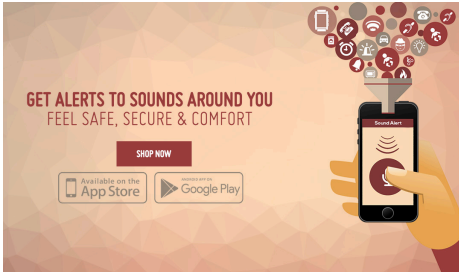
Optical Character Recognition (OCR) Device



This device digitises printed text, so that they can be electronically edited, searched, displayed and read out. This is especially helpful for persons with low vision or are fully blind as hardcopy documents can now be digitised and read out to them using this device. Employers can use this device for job roles that require frequent handling of hardcopy materials.

AREA TO ADDRESS	ASSISTIVE TECHNOLOGY DEVICE/SOLUTION	APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK
	<p>Electronic Braille Notetaker</p> 	<p>This device enables braille learners with full vision loss to 'read' the digital content on screen, and also 'write' notes or documents which can be transferred to the computer. The notetaker 'reads' by scanning the on-screen content and displaying the text as braille with its refreshable braille display (small plastic or metal pins that move up and down to display the braille characters as it reads the text).</p> <p>The user can 'write' notes or transcribe using braille with the six large keys which corresponds to the six dots in the braille cell. This is most helpful during a meeting where the user needs to listen to the speaker to take notes, and is unable to listen to the computer screen reader as he/she types. The notes taken from the device can then be transferred and stored in various storage devices or computers. More recently, braille notetakers can also come in the form of eight keys to allow the use of eight dots to represent more information in a single braille cell e.g. more symbols or punctuation. This is particularly for use with braille embossers and refreshable braille displays, making braille documents more concise and readable to persons with visual impairment.</p>

### C. EXAMPLES FOR PERSONS WITH HEARING IMPAIRMENT

AREA TO ADDRESS	ASSISTIVE TECHNOLOGY DEVICE/SOLUTION	APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK
<p><b>Respond to Environment Signals</b></p>	<p>Assisted Hearing Mobile Application <i>Sound Alert</i></p> 	<p>Sound Alert is an app that helps persons with hearing impairment to record and recognise sounds in both the indoor and outdoor environments, and alerts users through push notifications and vibrations.</p> <p>Employers can add sounds to be noted at the workplace (such as emergency alarm or doorbell) into the app, so as to alert the persons with hearing impairment to react accordingly.</p>

**AREA TO ADDRESS**

**ASSISTIVE TECHNOLOGY DEVICE/SOLUTION**

**APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK**

**Interpersonal Communication**

Instant Messaging Software

- 1. *Whatsapp Messenger*



- 2. *Glide (video-messaging app)*



WhatsApp messenger and Glide are some examples of readily-available commercial solutions which employers can use to communicate with employees with hearing impairment.

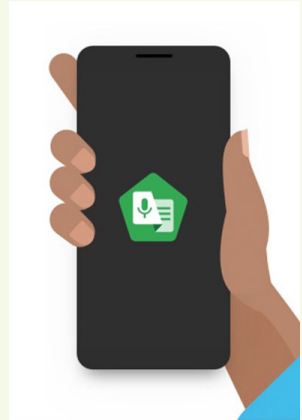
The Deaf community uses video messenger (Glide) to converse with each other using sign language, as signing is their preferred medium and is faster than writing.

Communication Mobile Application

- 1. *Flip Write AAC*




- 2. *Live Transcribe*



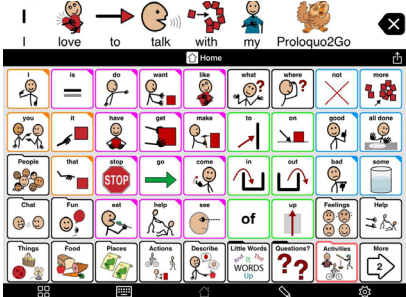
Flip Write and Live Transcribe allow employees with hearing impairment to communicate faster with their co-workers through a flipped display which can be seen by both parties. The simple interface allows for a message to be typed at one end, and automatically flipped and displayed real-time on the other end for co-workers to read and easily type back. This is particularly useful during one-to-one or small group discussions.

Live Transcribe, a free Google app, automatically transcribes speech into text in near-real time to offer representation of spoken conversations for the deaf or users with hard of hearing.

Live Transcribe also supports up to 70 different primary languages, and is able to correctly transcribe short phrases in another language without switching.

AREA TO ADDRESS	ASSISTIVE TECHNOLOGY DEVICE/SOLUTION	APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK
<p><b>Group Training or Meeting</b></p>	<p>Wireless Microphone and Receiver (best used for group meetings, conferences)</p> <p><i>E.g. Phonak Roger Pen system</i></p> 	<p>Most persons with hearing impairment wear a hearing aid. The issue with the hearing aid is that it picks up and amplifies all sounds including sounds from the surroundings e.g. waves crashing at the beach, road noises, people talking during a meeting. The hearing aid is not smart enough to discern between the various noises or focus on only amplifying human noises.</p> <p>With a system such as the Roger Pen, persons with hearing impairment can point the wireless microphone to the speaker of interest to listen through the receiver which will be connected to their hearing aids, and not be affected by the ambient noisy environment. This is especially good to be used during presentations and conferences. The speaker can just hold or hang the roger pen microphone as he/she speaks.</p> <p>If in a meeting setting, the Roger Pen can be placed lying flat in the centre of the table to enable it to be a 360 degree microphone, picking up the inputs from the group as the meeting continues. This reduces the sound distractions from outside of the meeting room/group.</p>

## D. PERSONS WITH AUTISM/INTELLECTUAL DISABILITIES

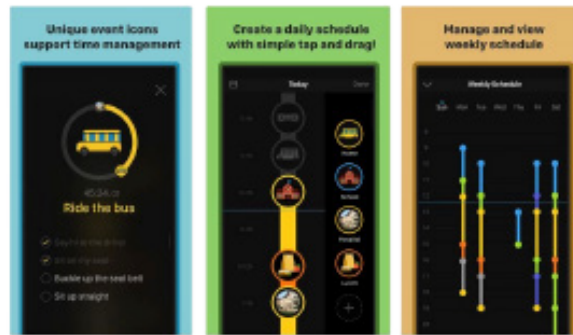
AREA TO ADDRESS	ASSISTIVE TECHNOLOGY DEVICE/SOLUTION	APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK
<p><b>Interpersonal Communication</b></p>	<p>Communication Mobile Application (<i>Proloquo2Go</i>)</p> 	<p>Proloquo2Go, with its well-researched predictive speech and extensive list of vocabulary, helps users with difficulty in speech projection or are non-verbal to find words and complete their sentences. These sentences will then be voiced out through the voice synthesiser in the application.</p> <p>Employers can use this to communicate, give instructions or get feedback from persons who may have difficulties in speaking.</p>

## AREA TO ADDRESS

Task Completion and Productivity

## ASSISTIVE TECHNOLOGY DEVICE/SOLUTION

Productivity Mobile Application



## APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK

A visual schedule app is a picture-based scheduler that allows users to keep track of scheduled activities, making days predictable and empowering users to be independent.

Employers can key in daily tasks and work protocol into this mobile application for employees to follow through and for supervisors to track work progress.

Scene Speak



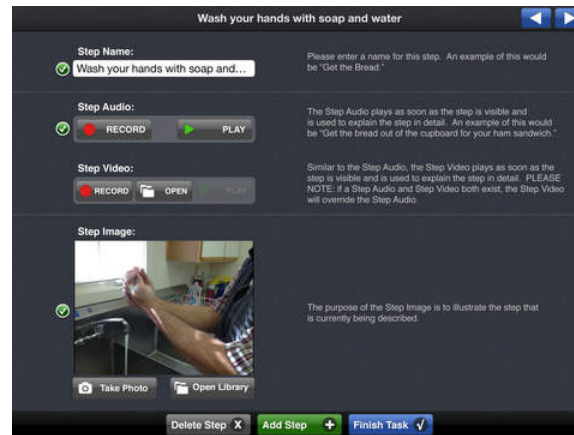
Scene Speak is a versatile, easy-to-use app that let users create interactive stories by adding text, sounds and speech to parts of pictures. Employers could create pictorial work manuals by taking photos of the work processes, and inserting instructions to each of these photos.

## AREA TO ADDRESS

## ASSISTIVE TECHNOLOGY DEVICE/SOLUTION

## APPLICATION OF ASSISTIVE TECHNOLOGY AT WORK

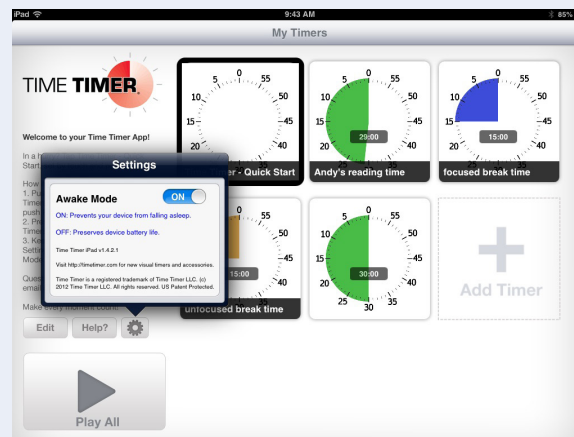
### Endeavor 3



Endeavor 3 helps persons with disabilities, especially those with intellectual and developmental disabilities to organise their day independently and check off items from a to-do list. This fosters greater independence and reduces support from employer's end.

For example, a cleaning supervisor can key in the daily cleaning schedule and route into the app, and employees with intellectual disabilities can follow through the schedule and complete the tasks, with minimal supervision and reminders from the supervisor.

### Time Timer



Time Timer is a digital timer that shows elapsed time in bright colours, and beeps and vibrates when the timer is triggered. It guides persons with disabilities who have challenges with attention span manage their time and complete their tasks. For example, supervisor can set a time limit to remind the employees with disabilities to resume work from any break.

## ENABLING FACT

For more information, you can visit <http://at-aust.org/search> for an updated database of assistive technologies available for persons with disabilities.

# 06

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How to Provide Accessible Content

## 6. HOW TO PROVIDE ACCESSIBLE CONTENT

Employers could help make the workplace more accessible by providing accessible content. Content to be made accessible would be work materials (word documents, notes, slides) and corporate website content. This can be done by making adjustments during the design and preparation phase of materials and websites.

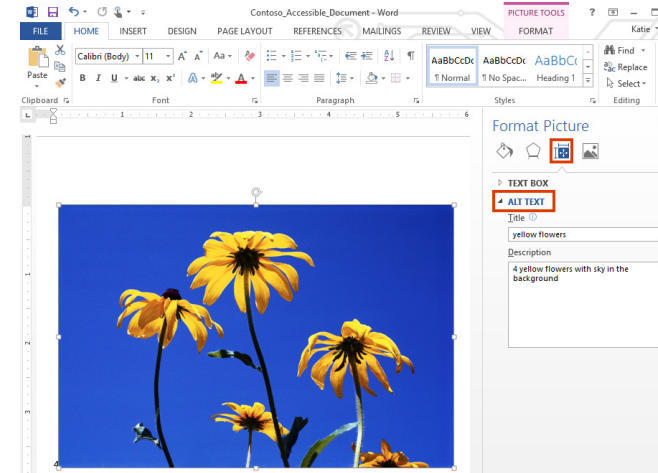
Here are some examples of making materials accessible:

### A. FOR WRITING

1. Keep a 1.5 spacing between lines and use font types that are of uniform thickness and width such as Verdana, Lucida and Georgia. They provide greater reading legibility.
2. Use the various heading styles and formatting tools found in your word processing software to help guide your organisation of information. A clear and consistent organisational structure of information helps persons with disabilities who use screen-readers, to read and understand the flow of content more easily.
3. Ensure that your documents are free from spelling errors as they can be distracting to screen-reader software.

### B. FOR VIDEOS, PICTURES

1. Include alternative text descriptions for pictures, images or videos. The descriptions should be meaningful such as 'This is a chart that shows an upward trend in the prices of rise over years 2000 to 2015. It has increased from \$15 to about \$30 over the past 15 years', rather than a label of 'Figure 1'. This will help users make sense of the graphics, and persons with visual impairments can understand the content with the use of screen-reader.



Source: Georgia Tech Information and Communication Technology (ICT) Accessibility course

2. Include closed captions on videos which may be embedded in your company's website or presentation materials. This can help persons with hearing impairment understand the video better.

### C. FOR MATERIALS

To check for materials accessibility, a readability test can be conducted on your documents to assess the level of accessibility and readability. There are various online calculators such as Flesch formula or Fry readability graph. You can also use Microsoft's Accessibility Checker to check the accessibility on Word, Excel or Powerpoint documents.

#### ENABLING FACT

The National Center on Disability and Access to Education (NCDAAE) has released an information guide to help you customise the materials to be more accessible. You can visit <http://ncdae.org/resources/cheatsheets/> to learn more.



## D. FOR WEBSITE

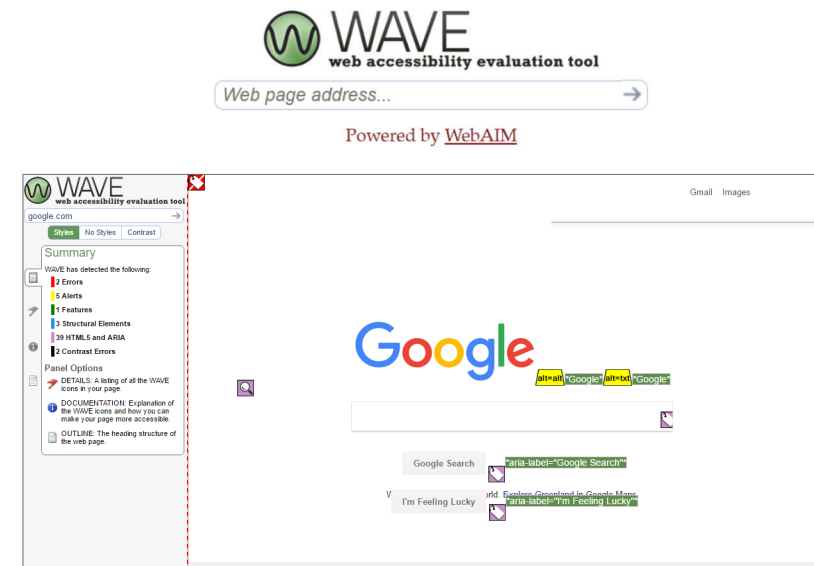
Here are some examples of making websites accessible to allow persons with disabilities to perceive, understand, navigate, interact and even contribute using the Internet:

1. Ensure website content is free from spelling and grammatical errors.
2. Ensure that all content can be accessed with the keyboard alone in a logical way by pressing the "tab" or "arrow" keys, or through the use of alternative input devices such as single switch input or mouth stick. As a result, the tab order should match the visual order, so keyboard-only users are able to logically navigate through site content.
3. Long pages with lots of content should be broken up with anchor links (jump lists), allowing users to skip to relevant portions of the page without having to negotiate through other content. "Skip to main content" should be provided at the top of each page, so keyboard-only users won't have to tab through the page navigation in order to get the main content.
4. For application forms needing user input, break application into sections/pages and include the option to save the data in each section/page. This is to allow flexibility for the applicant to return and complete the form later.
5. For filling in of forms, build in the option to allow the extension of timelimit, to prevent timeout.
6. Label each field and explain the type of information needed (e.g. with country code, no hyphens).
7. Ensure that the website can also be easily viewed on a mobile platform(e.g. layout and order of questions mirrors the display on computers).
8. Default foreground and background color combinations provide sufficient contrast.

9. Text is resizable up to 200% without losing information, using a standard browser.
10. Users can pause, stop, or adjust the volume of audio that is played on a website.

### ENABLING FACT

Web Accessibility Initiative develops guidelines widely regarded as the international standard for web accessibility. You can visit <https://www.w3.org/WAI> for more guidelines and resources to make the web accessible to persons with disabilities. Employers can also use a Web Accessibility Evaluation Tool (WAVE) developed by WebAIM (Web Accessibility In Mind). To use WAVE, simply enter the web page to be evaluated in the search box at <http://wave.webaim.org/> and a report will be generated in the left column. Clicking the "Details" tab will highlight all the issues that could be addressed on the webpage."



Example: Web Evaluation of [www.google.com](http://www.google.com)

# 07

Key Considerations for Adopting Assistive Technology or Accessible Content

## 7. KEY CONSIDERATIONS FOR ADOPTING ASSISTIVE TECHNOLOGY OR ACCESSIBLE CONTENT

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Now that employers understand the types of assistive technologies (AT) are available and ways to make content accessible, there are some key factors for employers to consider when adopting the suitable AT for their employees with disabilities.



### A. LEVEL OF TECHNOLOGY

Generally, AT can be broadly categorised into low tech and high tech. It is possible that there is a solution in each category that can solve the same problem. For communication with a person with hearing impairment, the traditional method of using pen and paper would work fine. However if company budget allows, a speech-to-text software could allow the person with hearing impairment to read what the speaker is talking about in real-time.



### B. COST

As per the example above, a low cost AT could achieve the same outcome as a high cost one. The differentiating factor will be the efficiency in achieving it. Employers would need to balance productivity versus the cost of implementation. Most importantly, the cost must be reasonable, and within the financial means of the employer.



### C. PLATFORM/ MEDIUM OF TECHNOLOGY

This depends on the needs of the person with disability using the AT device. For persons with low vision, a hardware magnifier helps magnify documents for easy reading. For those who are comfortable with the use of a computer, a software magnifier works just as well.



### D. SCALE OF IMPLEMENTATION

Implementation can be at System-level in the organisation or at Individual-level. Systems in this case may refer to having standard procedures or retrofits in place to aid persons with disabilities. Making content accessible through the organisation, or placing all files on low shelves, or installing height adjustable desks in the whole office etc., are ways to help support employees with disabilities at work.

Most persons with disabilities would also have their personalised individual AT devices such as wheelchairs, hearing aids or personal laptops, which they have grown accustomed to using. Instead of implementing solutions as a whole in the workplace, employers can also check with their employees with disabilities if they are able to rely on their own individual devices to help them at work.



## E. LEVEL OF CUSTOMISATION

Smart mobile devices now have in-built accessible features which enable general users including persons with disabilities to read documents, communicate and work efficiently, without the need to rely on additional specialised AT devices. While specialised AT still serve its purpose in niche cases, mainstream devices are providing a low cost option while enabling greater independence.

The following case study illustrates how can employers better understand the needs of their employee with disability, know what is available in the market and consider the key factors before adopting the appropriate AT and/or accessible content.

## CASE STUDY



John is an employee with cerebral palsy who is working as an executive in a bank. He experiences difficulties with fine motor movement and is slow in typing on the computer. As his workload in the bank increases, he finds himself struggling to finish his data entry tasks and his supervisor noticed that he was not generating as many reports as he expected. His supervisor had recently attended a course on adoption of AT and decided to understand John's needs using the following questions:

### **1. What is the scope of work for the employee?**

To do data entry on the computer and generate reports for the bank.

### **2. What existing AT is the employee using (that contributes to the work)?**

John has cerebral palsy which affects his motor movement and hence uses a motorised wheelchair to get around. John's supervisor has already provided a computer mouse with bigger switch buttons to aid him in his mouse cursor navigation across the screen.

### **3. What existing workplace accommodation can support the employee in his/her work (including personal needs such as toileting, feeding, travel)?**

John's supervisor has allocated him an office seat nearest to the lift and toilet, as well as an adjustable height table to accommodate his motorised wheelchair.

### **4. Examine the current state of work processes or content accessibility for the employees.**

Current work processes and content accessibility are not an issue for John.

### **5. What are the gaps that can be addressed in terms of accessible content?**

No gaps in terms of accessible content.

### **6. What are the gaps that can be addressed by additional workplace accommodation in the form of AT devices?**

John could have an AT device which could enable him to type faster on a keyboard.

## 7. How should these gaps be filled?

For this question, John's supervisor will need to know what types of AT devices are available to enable John to type faster or easily.

John's supervisor researched and found the various types of AT devices available in the market to aid in typing on the computer:

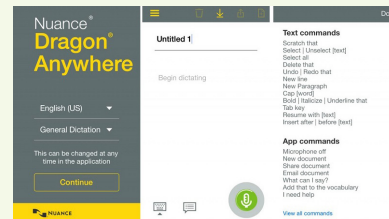
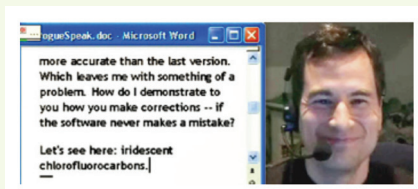
- Customised keyboard with bigger keys to press.



- Keyboard with key guards.



- Speech recognition/ Dictation software e.g. Dragon naturally speaking software.



(Refer to section on AT devices for the physically impaired for more details on these).

We can refer to the key factors for consideration in adopting the appropriate AT for John:

### A. LEVEL OF TECHNOLOGY

Customising the keyboard or putting a keyguard for John is a lower level of technology compared to using a speech recognition software. Hence, customising the keyboard or putting a keyguard will be easier for John to use with minimal effort in training him to use it. However, the higher level of technology option of using a speech recognition software may be more efficient in the long run but will take a longer time for John to programme his voice to give accurate commands in the initial stage.

### B. COST

Customised keyboard and keyguard is of a lower cost than purchasing the speech recognition software which may be charged on subscription basis. Depending on the budget of the company, John's supervisor will have to assess the total costs of the options, taking into account not just the initial cost, but also the possible future costs of logistics hardware replacements or renewal of subscription.

### C. PLATFORM/ MEDIUM OF TECHNOLOGY

Customised keyboards and keyguard is using hardware so will need to consider the physical space limitations. Is there enough desk space if a customised keyboard with bigger keys are used?

Speech recognition is using software to solve the issue, so will need to consider the compatibility of existing company operating systems to this software.

## D. SCALE OF IMPLEMENTATION



John's supervisor will need to consider if this AT should be implemented at a system level or at an individual level. He will then need to think through a few questions:

- Will John need to use more than 1 PC to perform his task?
- Will the company have more employees with difficulties in fine motor skills and typing?

If yes, then it makes sense to install the speech recognition software in more computers or buy keyguards for more keyboards. Else, it should be implemented at the individual level.

## E. LEVEL OF CUSTOMISATION



These options are all quite highly customised products which are not available in the mainstream market and will need to be specially purchased.

As a result, John's supervisor considered all the above factors and deliberated that John needed an AT device which:

- Does not need a steep learning curve to pick up and easy to use.
- Is of low cost due to the tight budget of the bank due to the bad economic times they are experiencing.
- Does not take up too much desk space.
- Can be easily replicated on other computers in the event he needs to access other computer systems to type or if his computer breaks down and needs a backup.

> The customised keyboard with big keys will take up too much desk space and is too customised and not easily replicated, which also means higher cost to replace.

> The speech recognition software is not easy to learn, programme and use, is of a higher cost and has to be installed on more computers if John has to access other computer systems. Also, it will need to be continually upgraded as the bank's operating system software changes too.

> Hence, the keyguard is the most suited to John's needs for this task. It is easy to learn, to use, easy to replace and to replicate on other keyboards (if needed). It is low cost and can fit on the existing keyboard without taking any additional desk space.

Since the implementation of the keyguard, John was able to type a lot faster without hitting other keys unintentionally and generate his reports at a faster pace than before.

08

  
Tech Able

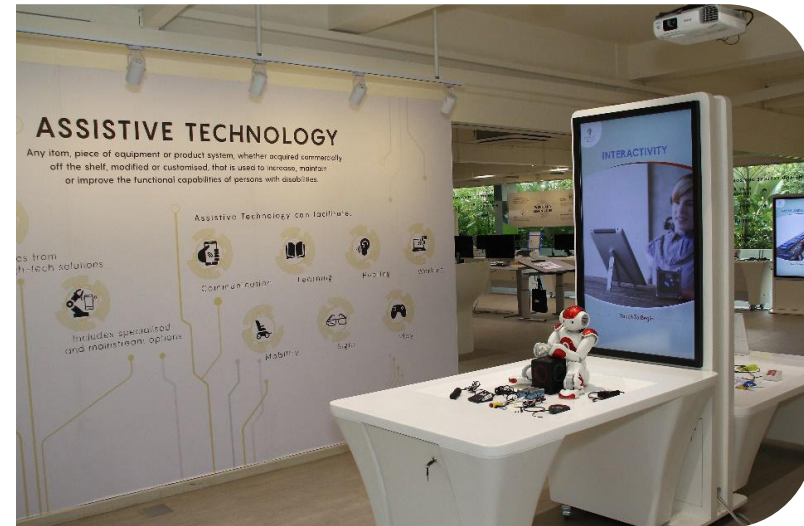
## 8. TECH ABLE

For employers who are keen to learn more about assistive technology (AT), and have a preview of AT devices most suitable for the workplace, they are welcome to visit Tech Able, an integrated assistive technology space. An initiative by SG Enable and SPD, Tech Able aims to increase awareness and promote the adoption and benefits of assistive technologies in enabling persons with disabilities in various aspects of their lives.

Tech Able is:

**A Smart Home and Infocomm Technology Showcase:** You can explore a wide range of assistive technologies that meet various needs and budgets. You can explore and interact with accessible and universally designed assistive technologies for work and living spaces.

**A Communications Training Lab:** A laboratory with computers fully equipped with appropriate assistive peripheral technologies, training courses are conducted here to train and prepare persons with disabilities in employment.



**An Innovation Space:** You can look to organise events and workshops in this space. We welcome Innovators, makers, technology start-ups to discuss, test ideas and share information on assistive technology.

**A Centre with Assistive Technology Consultation, Assessment and Training Services:** Look for advice on adoption of appropriate assistive technologies with SPD's assistive technology specialists. These professionals will be on site to provide consultation, assessment and training services for persons with disabilities.

**An Assistive Technology Showcase and Loan Library:** Explore a range of devices and learn about the different considerations in choosing appropriate solutions to meet your needs. Assistive technology solutions are also available for loan to persons with disabilities.

**An Experiential Room:** You can testbed products for the visually- and hearing-impaired in a fully-equipped soundproof, lightproof room.







Tech Able is open on Monday to Friday from 9am to 5.30pm. To learn more about Assistive Technology devices, visit <https://techable.enablingvillage.sg/> For collaboration opportunities, write to [techable@sgenable.sg](mailto:techable@sgenable.sg).

To request for a therapist appointment to assess your needs, download the Assistive Technology Referral Form (pdf) and complete pages 1 and 2. You should also complete page 3 if you need an assessment for Augmentative and Alternative Communications (AAC). Please email the completed form to [atc@spd.org.sg](mailto:atc@spd.org.sg) and you will be contacted for an appointment. For more information, please call 6473 0446.

**ENABLING FACT**

Under the **Open Door Programme**, the Job Re-Design Grant helps employers to recruit and retain employees with disabilities, by supporting 90% of the job re-design costs, capped at \$20,000, whichever is lower, per employee with disability. It can be used to defray the cost for job re-design initiatives, which includes the purchase of assistive work devices.

For persons with disabilities who wish to purchase devices on their own, they can tap on the **Assistive Technology Fund**, where successful applicants who qualify for the means-test, can receive subsidy of up to 90% of the cost of the required equipment, subject to a lifetime cap of \$40,000.



09

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Conclusion

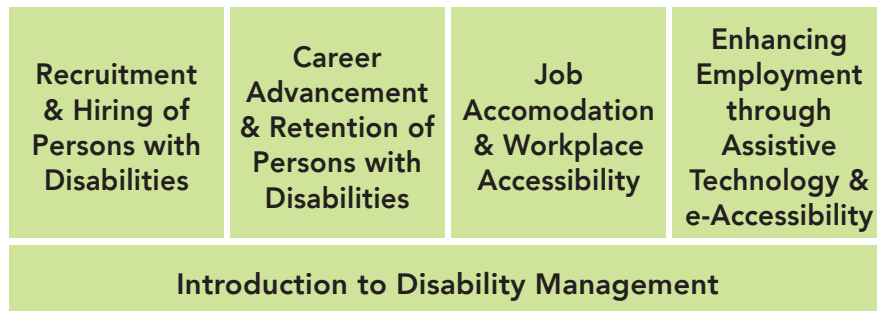
## 9. CONCLUSION

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Most persons with disabilities would already utilise an assistive technology (AT) device to get around their daily living. There are a variety of AT devices and accessible content solutions that will enable persons with disabilities to overcome barriers in their daily tasks and at work, thus enabling them to be independent and productive in the workplace.

However, employers should bear in mind that the needs of every employee are different, even if they have similar disabilities. As such, it is necessary for employers to discuss with every employee with disability and other medical/health experts (e.g. occupational therapists) to understand their needs before deciding how best to support them with AT.

**For more in depth information, you may wish to attend SG Enable High Impact Retention & Employment (HIRE) Workshop series.**



Please refer to <http://employment.sgenable.sg/training/training-programmes/> for the training courses for different stakeholders and <https://employment.sgenable.sg/employers/get-trained/> for more information on employers training

## REFERENCES

<sup>1</sup>WHO (2011). World report on disability. Geneva, World Health Organisation

<sup>2</sup>WHO (2013). Definition on e-Accessibility

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ZoomText  
[www.zoomtext.com](http://www.zoomtext.com)

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**Inclusive society. Enabled lives.**

SG Enable Ltd  
20 Lengkok Bahru  
#01-01  
Singapore 159053  
[www.sgenable.sg](http://www.sgenable.sg)

Infoline: 1800-8585 885 (Monday to Friday 8.30am to 6.00pm;  
Saturday 8.30am to 12.30pm; closed on Sunday and Public Holidays)

For enquiries or feedback: [contactus@sgenable.sg](mailto:contactus@sgenable.sg)

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